BULLETIN

OF THE

AMERICAN GEOGRAPHICAL SOCIETY.

Vol. XXXVIII 1906. No. 12

THE NORTH-EAST COAST OF GREENLAND, BEYOND 77° N. LAT.

In the summer of 1905 the Duke of Orleans chartered the Belgian exploring ship *Belgica,* made a cruise in the East Greenland Sea, reached the coast of Greenland in the neighbourhood of Cape Bismarck, the most northern point fixed by the Koldewey expedition, and ascended the unknown coast for about 120 miles (BULL. of the Amer. Geog. Soc., 1905, pp. 672-3). A paper on this exceptional voyage, written by Captain de Gerlache, leader of the Belgian Antarctic expedition, who accompanied the Duke, is published in *La Géographie* of the Paris Geographical Society (Vol. XIV, No. 3, September, 1906).

The chief purpose of the Duke's expedition was to make oceanographic studies in the Greenland Sea between Spitzbergen and Greenland. This part of the Arctic Ocean to the north of the 77th parallel was practically unknown, and few precise soundings had been secured away from the coast of Spitzbergen. The *Belgica* was, therefore, provided with the equipment of a modern oceanographical expedition. It was little expected that she would be able to cross the Greenland Sea from Spitzbergen in unusually high latitudes.

The following facts concerning the *Belgica's* voyage are condensed from Captain de Gerlache's paper; and our map is reduced from one of his two maps, published by *La Géographie.*

The *Belgica* left Tromsö for Spitzbergen on June 3, 1905. After spending several weeks along the west and north coasts of this archipelago, a course was taken to the northwest, and on July 9 the

pack ice was reached in 80° 20′ N. Lat. and 5° 40′ E. Long. The edge of the pack was followed to the southwest, in the hope that an opening might be found through which the ship could reach the Greenland coast in a high latitude. The experience of the whalers in the great days of that industry was that the coast could best be reached through the ice between 72° and 74°; but polar navigation has no absolute law, and the expedition desired to ascertain if the pack could not be traversed at a much higher latitude.

The numerous soundings secured on this southwestern voyage along the edge of the pack ice were the first to be obtained in the central regions of the Greenland Sea in latitudes between 75° and 80° N. A little above the 78th parallel a depth of 2,700 meters was found; nine miles further west the depth was 2,100 meters; 19 miles further west it was only 1,425 meters. About 70 miles south of these soundings, on nearly the same meridian, the depth decreased from 2,600 meters to 1,275 meters in a few hours' steaming. These soundings indicate a submarine ridge extending roughly north and south.

The course was now mainly west not far from the 76th parallel. A little west of 10° W. Long. soundings of 340 meters with gradual shoaling further west showed that the continental shelf had been reached. Here the ship rounded the southern terminus of the impenetrable pack and made its way to the northwest and west.

On July 28, in 77° 5′ N. and 17° 50′ W. the *Belgica* passed within four miles of the cairn erected in 1870 by Koldewey and Payer on the coast of King William Land. But these explorers attained this northing only after a difficult sledge journey of 150 miles from the winter quarters of their exploring vessel *Germania*. They were twenty-two days on the way north, and the cold was intense. The *Belgica* party, on the contrary, reached the same point in a good ship offering considerable comfort; and the temperature was 2° C. above freezing. The contrast was striking.

From what they saw of the ice conditions Payer had felt justified in saying that "except under unusual circumstances no vessel will ever advance along this coast." The *Belgica* had met these exceptional circumstances. For a time there was no impediment to progress northward, excepting fog. Between the impenetrable pack ice and the land ice, which was still solidly attached to the coast, there was a channel full of floating ice, but still navigable.

No time was lost in starting northward in this channel. The explorers felt their way along through the mist past Cape Bismarck. The fog prevented them from seeing the Greenland coast, but fre-

quent soundings gave them some clew to their distance from it. Then the fog suddenly lifted, and they saw, to the west, the Greenland coast, and in the northeast a large island or a promontory. This discovery was most joyfully welcomed. A party was sent out over the land ice to this new island, from which the *Belgica* was seven or eight miles' distant. They reached the land, which was christened L'île de France, and made a rapid reconnaissance. The island is an old moraine, rising gently to a height of 160 meters. The southern slope, which was easily ascended, was almost bare, while the interior and northern slope were covered with névé. The promontory at the southeast end of the island received the name of Cape Philippe (77° 38′ N. and 17° 36′ W.).

Although on the rocky surface there was but little soil, the flora was more abundant and varied than that of the islet of Marussia (south of Cape Bismarck), and nineteen phanerogamic plants, seven varieties of moss, four of fungi and six lichens were added to the collections. They found many white hares and in the snow traces of foxes and geese. A lemming was captured. At the highest point of the island a cairn was erected, and a record placed.

Returning down the slope, they found a little worm-eaten structure that puzzled them very much. No trace of a camp could be found, and the rough surface thereabouts was not favourable for erecting tents. The explorers, therefore, came to the conclusion that what they had found was the remains of a fox trap rather than of a human habitation. However this may be, the evidence of the former presence there of Eskimos has its importance, as strengthening the hypothesis that the nomad tribes which reached Greenland from the North American archipelago finally attained the east coast of the island by passing around its northern end.

Around the ship flew terns, petrels and gulls. Now and then a bearded seal (*Phoca barbata*) was seen. During the night numerous narwhals came out from under the winter ice that extended between the Greenland coast and the Ile de France. They swam towards the south in schools of six or seven.

On July 29 the *Belgica* was moored to the land ice near the west point of the island (Cape Saint Jacques). While waiting for the fog to rise so that they might fix the position of this promontory, they took a series of oceanographic observations and secured specimens of plankton. On July 30 the fog was less dense and they could dimly see the island. They weighed anchor in the morning and skirted the coast to determine the orientation of the southern shores of the Ile de France. At 11 o'clock they reached Cape

Philippe. Thick ice extended from the shore. Hugging the outer edge of this ice, they gradually lost sight of the island, and did not know till the fog lifted that they had been following the land ice. Soundings were kept up at intervals of two hours and distances of about six miles. They found depths of 45 meters, then 290, 375, 395. They were getting away from the land and were steering to the N. 15° E.; but about 11 P. M. the wall of ice they had been following since morning turned more to the east and they had to steer to the N. 30° E.

At midnight they reached 78° 16′ N. and 16° 48′ W. They were then 167 miles to the north of the extreme point previously attained on that coast by an exploring vessel (*Germania*, 75° 29′ N., July 27, 1869). It was about the highest point they could reach. The fog, lifting for a moment, enabled them to gaze over the sea. It was covered with heavy ice. They could not push much further towards the north. Undoubtedly, they might have added some minutes of latitude to their record, but they could not run the risk of being caught in the ice, for they were not prepared to spend the winter in the Arctic. They desired, however, to utilize their exceptional position by taking a few soundings further east.

At midnight on July 31 the lead showed 470 meters. At 4 o'clock the next morning, fifteen miles further east, the sounding was only 220 meters. Three hours later bottom was found at 100 meters. Things were becoming interesting. The ice was growing more compact and the *Belgica's* prow had to be turned to the southeast. At 11 A. M., about 30 miles east of the midnight position, the depth was only 58 meters, and pebbles were brought up. They had discovered a morainic bank, which they named the Belgica Bank. They thought they might be in the neighbourhood of an island, for they saw two ravens and a walrus, and these animals are never found far from land. The explorers were eager to elucidate this interesting problem, but circumstances compelled them to leave it to others. The fog lowered again; to the north and east the ice had become almost impassable, and nothing more could be done there except to take a few soundings in the east-south-east. In this direction the ice was a little more practicable, yet it formed such a maze of channels that in the fog it was difficult to find a way through. The soundings showed 75 meters, then 115 and 200 meters. An observation of a horary angle enabled them to fix the longitude of the last sounding at 13° 36′ W. The latitude was estimated at 78° 7′ N. They were forty miles east of the coast of Greenland, in the midst of the great white space left on the map by earlier explorers.

The pack was becoming more and more unmanageable, and it was decided to regain the Ile de France, in order to fix its position a little more precisely. The explorers sounded frequently during the rest of the day. At 11 P. M. the fog lifted a little and they saw to the west the reflection of the land ice and of the land projected on the sky in two strata, the "iceblink," all white, and the "land-blink," a yellowish white; then the fog veil became still thinner, and very elevated land appeared in the distance. Seaward the cloud banks hung low on the ice, and their hope of seeing the land, whose existence had been suspected, was disappointed.

On August 1 the pack was rather more navigable, and the route was slightly inclined to the north, in order to catch a glimpse of the most northern land to be seen from their position. At 4 o'clock they reached the ice wall they had skirted the day before. It was the edge of the land ice, and they made fast to it to take the bearings of land that was in view. The land ice formed a solid field covered with soft snow, in which they sunk to their knees. The ice stood from 1½ to 2 meters above the sea and its edge extended about N., 15° E. The edge was nicked with breaks and cracks made by the floating ice brought down by the polar current. There was little evidence that pieces of the land ice are detached from the mass by thawing. The mass had every appearance of stability. To the south of Ile de France, however, the land ice had a very different aspect. It emerged above the sea only thirty to forty centimeters. Ravages had been made by melting, and the uneven surface enclosed great pools of water. Large pieces detached from the land ice moved off to mingle with the polar pack.

During the morning the floating ice moved along the edge of the land ice, carried to the northward by a current of 275 meters an hour. In the afternoon, however, the drift was towards the south at a rate of movement only one-third as great. The *régime* of flux and reflux currents was recognized here, one of them nullifying and even more than counteracting the polar current and the other accelerating its rate of movement.

At 2.30 A. M. on August 2 the lower part of the land appeared; then, little by little, the fog veil was completely lifted. They saw before them an immense panorama of the Greenland coast, stretching from 80 to 90 miles. Mérite took advantage of this opportunity to catch a detailed view of the coast, while Bergendahl and de Gerlache took a series of bearings. At 5 o'clock the *Belgica* cast off and proceeded south along the land ice.

The day was radiant, and at 4 P. M. the thermometer marked

3.8° C. The men were quite warm. After doubling Cape Philippe, the vessel was moored at the edge of the land ice near Cape Saint-Jacques. Next day, in fine weather, the position of Cape Saint-Jacques was determined—77° 36′ N., 18° 10′ W. A round of angles was also taken from this point.

On the beach, near the point of observation, they discovered one of those circles of stones carefully placed together, in which earlier explorers thought they recognized "tent circles." The Eskimos have a habit of securing their tents by placing stones in a circle around them. It seemed to the Duke of Orleans and his comrades, however, that when the Eskimos struck camp and folded their tents, they would not be careful to leave exactly in a circle the stones that had held their tents to the ground. In their opinion these circles did duty rather as the foundations of snow huts. They discovered no other evidence of the existence here of Eskimos. They found, however, on Cape Saint-Jacques a musk-ox skull and a bit of drift wood. They saw also ravens, a skua and a sea woodcock (becasseau de mer).

In the morning a strong south current carried the floating ice against the edge of the land ice, and before the explorers could cast off their hawsers the *Belgica* was completely closed in. The rudder was considerably damaged and, for several hours, the expedition was in an unpleasant situation. In the afternoon, however, with the aid of the wind, they were able to get out of the ice and continue the voyage south.

On August 4, they made fast to the edge of the land ice, and the Duke of Orleans and Dr. Récamier, with a few of the men, started west for a trip over the ice to Cape Amélie. The ice was rapidly breaking up, but, in spite of many obstacles, they nearly approached their destination when they found that the land ice was detached from the coast, and, as they had no boat, they were forced to beat a retreat. The party returned after twelve hours, greatly fatigued by their difficult march over the spongy ice. Though they missed the satisfaction of planting their flag upon this point of the Greenland coast, they gained at least the impression that Cape Bismarck is not a promontory of the mainland, but is the southern point of a large island. On this day numerous narwhals passed the ship in schools of five or six, swimming south in the morning and north in the afternoon; or, in other words, against the current each way.

The accompanying map, showing the part of the coast of East Greenland between 77° and 79° N., was the result of a very rapid

reconnaissance carried out under unfavourable conditions: "We show on this map what we saw and probably not all that is really there." Cape Bourbon, which seemed to be an island, was observed only from one point, and that was from the masthead. Only one azimuth was available to fix the position of Cape Bergendahl. All the other salient points of the map were the result of two or more compass bearings. Noteworthy points mapped as capes may be promontories, or perhaps they are simply elevated areas behind the coast, and they alone came into view. Are the white spaces which separate them fiords or wide valleys? The *Belgica* explorers express no opinion on many such questions. As far as they could conjecture, both from what they saw and from what is known of the coast regions to the south of 77° N., the part of the East Greenland shore between 77° and 79° N. is penetrated by deep fiords, many of which doubtless communicate with one another in the interior. The lands are covered with an immense sheet of ice (the inland ice), above which black rock escarpments are sometimes seen. Glaciers may, perhaps, be found in the ravines; but the explorers saw no evidence that glaciers descend to the sea, except in the case of the local glacier, which moves down the southeast slope of the Ile de France. No true iceberg was seen in the Greenland Sea.

It was impossible to give careful attention to tidal movements along the coast, though while the ship was moored to the land ice there was conclusive evidence that the currents to the north of Cape Bismarck alternate, one of them flowing to the north and the other more rapidly to the south. To the south of the Ile de France, where the waters are not affected by the great polar stream, the alternating currents appeared, other things being equal, of the same intensity, and they are evidently the tidal currents.

The coast ice to the south of the Ile de France differs from that to the north. In the south it is annual or, in other words, it forms every winter, while in summer part of it disappears by melting and a part drifts away in large floes. In the north it seems to be always attached to the coast and to be reduced chiefly by the grinding action of the floating ice. Along the edge of this land ice, both to the north and to the south of the Ile de France, was a channel sufficiently free from ice for navigation.

On August 5 a landing party reached the land a mile north of Cape Bismarck, where the ruins of an Eskimo village were found. They consisted of a dozen stone circles and three graves. The shore was barren, but a little above it was vegetation in considerable variety, and a little inland there were even pastures. The explorers

were surprised to find no sign of the musk ox here. They saw, however, many traces of the hare and lemming, also of snow buntings, terns, and sandpipers. Next day they landed again at the southern point of the largest of the Koldewey Islands (Cape Arendts), a low point of morainic origin, which extends seven or eight miles further south than is shown on the German map. The channel between the islands and the Greenland coast was still entirely covered with winter ice. Floating ice massed compactly to the north and east of Shannon Island compelled the Duke of Orleans to forego his intention of visiting this island, and also prevented a near approach to Franz Josef fiord. The season was now far advanced, the nights were cold, and sometimes the sea was covered with young ice. It was time to reach the open sea.

On August 12 the sun disappeared for a few minutes below the horizon. The *Belgica* was steaming south in pack ice that now was easily navigated and then was quite compact. Everything was enveloped in dense fog.

On August 15 the *Belgica* steamed east, and on the 17th in 70° 38′ N. and 15° 22′ W. she felt the ocean swell. The wind was fresh from the southeast, and the ice was massed in wide belts. The fog hid the surface of the pack and the channels through the ice. At 2 P. M. on the 18th the ship reached a compact belt of ice, which was thrown into long undulations by the swell. At 8 o'clock that evening the open sea was reached, and four days later the *Belgica* anchored in the harbour of Reykjavik.

During six weeks in the Greenland Sea there were 482 hours of fog; that is to say, in the proportion of one day to two. The maximum frequency of fog occurred while crossing the pack from July 21 to 27 and from August 15 to 18. Really fine weather was exceptional. From July 22 to August 8 the temperature was above zero (C.), though frequently near the freezing point. The lowest temperature was —3.4°C. on July 16 at 4 A. M., and on August 9 at 2 A. M.; the highest temperatures were +7.2°C. on July 27 at 2 P. M. and +7.1° on August 7. The humidity was generally near the point of saturation. Very frequently the weather was perfectly calm, and the force of the wind was usually less than ten meters a second.

The ice pack in the summer of 1905 certainly presented very favourable conditions for navigation. The experience of the *Belgica* is corroborated by that of the Norwegian sealers. In May and June they found the edge of the pack ice more to the east than usual, and, being spread out more, the ice was less compact than in earlier

years. About the end of May the yacht *Excelsior,* from Tromsö, found the pack ice very scattered and penetrated 120 miles into it to 75° 30′ N. Two other vessels, the *Söstrene* and the *Severin,* crossed the pack and reached land early in July near Shannon Island. They found an ice-free channel along the coast, three to four miles wide, which they followed northward almost to Cape Bismarck, which no ship had reached before. The *Belgica* crossed the pack at a higher latitude than any ship before it had done. It was not easy, however, to keep the ship going in these latitudes; and if it had not been for the wish of the explorers to add new soundings to the map, they would have chosen an easier route from 50 to 100 miles further south. On the other hand, after they had made Cape Bismarck, no serious obstacle impeded their northern voyage to 78° 16′ N.

Eighty soundings were made, many of them in an unexplored zone; in fifty soundings temperatures and specimens of water were obtained at different depths; plankton was also secured at various depths at several of the stations. East Greenland was for the first time connected with Spitzbergen by a complete series of oceanographical observations. These observations have been co-ordinated in the Bergen laboratory with those of the same kind made by the International Commission for the Exploration of the Sea.

The meteorological observations which were made every two hours during the entire cruise were sent to the Copenhagen Meteorological Institute for comparison with those taken at the Danish stations in Iceland and Greenland. Captain de Gerlache says that Mr. Mylius Erichsen, who is now supposed to be with his expedition on the east coast of Greenland, will doubtless modify to an important extent the hasty reconnaissance of the *Belgica* party. The work of the *Belgica,* however, supplied useful information to Mr. Erichsen and proved the feasibility of his plans.

The technical results of the cruise will be brought out by the Duke of Orleans in a handsome publication early in 1907.

THE TENTH INTERNATIONAL GEOLOGICAL CONGRESS.

BY

E. O. HOVEY.

The Tenth International Geological Congress met in the building of the Instituto Geológico Internacional, Mexico City, from the 6th to the 14th of September inclusive, under the protection of President Diaz, and the honorary presidency of Sr. A. Aldasoro, Minister of Fomento, Colonization and Industry. The officers of the Congress were: President, Dr. José G. Aguilera, Director of the Geological Survey of Mexico; vice-presidents from each of the countries represented at the Congress; general secretary, Dr. Ezequiel Ordoñez of the Geological Survey of Mexico; and treasurer, Dr. J. D. Villarello, likewise of the Mexican Survey. More than 300 of the 500 members of the Congress were enrolled as being present at the meetings or taking part in the excursions. Twenty-one nationalities were represented among the delegates in attendance. About thirty papers were read in full or in abstract during the sessions in addition to the reports of the several standing committees, and twenty-eight papers were listed in the official programme for reading by title only. The extemporaneous discussions in the sessions of this Congress were particularly full, interesting, and valuable.

The opening session was held in the "Salon des Actes" of the National School of Mines, and was an impressive function, with the President of the Republic, Ministers of State, members of the Diplomatic Corps, and present and past officers of the Geological Congress occupying the platform, and with many prominent citizens of Mexico present with the congressists in the audience. After the addresses of welcome, the election of permanent officers, and the adoption of the programme voted by the council, the Congress adjourned to hold its scientific sessions at the new building of the Instituto Geológico Nacional. The first of these sessions was given over to communications on miscellaneous subjects, and the following papers were read: "Ueber das ältere Mesozoicum Griechenlands," by Doctor C. Renz of Breslau; "The Onyx Deposits at Etla, State of Oaxaca," by Dr. K. Keilhack of Berlin; and "On the Concurrence and Inter-relation of Volcanic and Seismic Phenomena," by Professor A. Heilprin of Philadelphia.

Professor Heilprin's general conclusions were that a broad interrelation exists between volcanic and seismic phenomena generally; that inter-related eruptions and earthquakes may occur at places hundreds, or even thousands, of miles apart; that tectonic earthquakes are only doubtfully to be distinguished from those of volcanic origin; that seismic and volcanic disturbances seem to be the expression of one common interior telluric strain or condition, and that this condition may in some or many cases be clearly associated with a pronounced magnetic or electro-magnetic quality of the planet; that superficial movements of the crust in connection with earthquakes are effects, not causes of disturbances. The paper was discussed by Messrs. Lawson, Becker, and Reid, none of whom could accept the conclusions of the author.

A report that will be of particular interest to American geologists was that of the committee appointed by the Geological Society of America at the Ottawa meeting (1905) to prepare a general geological map of North America. The committee consisted of Messrs. I. C. Russell (chairman), J. G. Aguilera, Bailey Willis, F. D. Adams, and C. W. Hayes. The report consisted of the completed map and two explanatory pamphlets by Messrs. Willis and Aguilera. The United States Geological Survey furnished the funds needed for publication, but the Mexican Government contributed toward defraying the expenses by purchasing a certain number of copies of the map for distribution among the delegates present at the Congress. The nomenclature adopted for the map is that of the U. S. Geological Survey, with which, unfortunately, the nomenclatures of the Canadian and Mexican Surveys do not correspond. The publication of this map is the first adequate step which has been taken toward filling a long-felt want. Professor A. C. Lawson, of the University of California, criticised the map for the manner in which the term Algonkian is used, saying that Eo-Algonkian is there made to comprise eras which are separated by the great Post-archæan unconformity, whereby an event of the utmost importance in the geological history of the North American continent is obscured.

Professor T. W. E. David, of the University of New South Wales, at Sydney, read a most interesting paper, illustrated with lantern-slides, on the glaciation of Australia during Palæozoic time. Striated erratic boulders occur in Lower Cambrian beds, but *roches moutonnées* have not been found. Striated boulders and *roche-moutonnéed* surfaces have been found in the Permo-Carboniferous strata of Australia, as well as in India, South Africa, and South America, indicating the wide extent of this Palæozoic glaciation. There has

been found, too, evidence of Pleistocene glaciation in Australia. In another paper Professor David announced the discovery of diamonds in the matrix at Oakey Creek, Inverell, New South Wales.

In a paper entitled "Ueber die Klimaänderungen der geologischen Vergängenheit," Professor F. Frech of Breslau elaborated the theme that the climatic evolution of the world from Palæozoic times to the present epoch has always been in certain correlation with the changes in the proportions of carbonic acid gas and water vapour in the atmosphere. Increase in the amount of these two factors present in the atmosphere is due to volcanic exhalations, while decrease is caused by organic and inorganic chemical combinations, particularly the latter. General L. de Lamothe of Grenoble read a paper on "Le Climat de l'Afrique du Nord pendant le Pliocène et le Pleistocène." Dr. Marsden Manson of San Francisco read E. W. Hilgard's paper on "The Causes of the Glacial Epoch," in place of his own communication on "Les Climats des Temps Géologiques."

The foregoing topic, "Conditions of Climate in the Geological Epochs," was the only one of the several broad questions announced for consideration at the Congress which was discussed in at all the manner expected by the Committee of Arrangement. Most of the disputants listed for the four set topics failed to attend the meeting—a fact that was embarrassing to the Committee and disappointing to the Congress. Through an unfortunate misunderstanding the men whose names appeared on the programme were not called upon by name to open the discussion of geological climates, so that some carefully-prepared papers were not read, although their authors were present. Those who actually took part in the discussion on climates were Messrs. Philippi, Burckhardt, Frech, Rothpletz, Diener, Kerner, Vorwerg, Coleman, Allorge, Davis, Fairchild, Becker, Heilprin, and David. Professor G. Stefanescu of Bucharest gave a description of a complete skeleton of *Dinotherium gigantissimum* Stefanescu, the first remains of the species having been found by the author in 1888 at Manzati, Roumania.

The topic "The Origin of Ore Deposits" was considered in the following set papers: "Some Relations of Paleogeography to Ore Deposition in the Mississippi Valley," by Dr. H. F. Bain of Springfield, Illinois; "Sur la Relation entre l'État Propylitique (Grünstein) des Andésites et la Genèse des Filons liés à cette Roche," by Dr. B. von Inkey of Buda-Pest; "Ore Deposits at the Contacts of Intrusive Rocks and Limestones, and their significance as regards the general formation of veins," by Professor J. F. Kemp of New York; "Sur le Remplissage de quelques Gites Metallifères," by Dr. J. D. Villa-

rello of Mexico; "Origin and Classification of Ore Deposits," by W. H. Weed of New York; and "Ore Deposition and Depth," by W. Lindgren of Washington. On account of the great development of the mining industry in Mexico and the keen practical interest in the question, such an array of papers naturally aroused animated discussion, which would have been much extended had time allowed. Those who took part in the discussion, aside from the authors of the papers read, were Messrs. Lawson, Becker, Bergeat, and Freudenberg.

The communication of J. G. Andersson, "On the Principal Results of the Swedish Antarctic Expedition," was read by Professor H. Sjögren of Stockholm, and illustrated by many interesting lantern-slides. Professor A. Heilprin of Philadelphia described the present condition of Mt. Pelé, as seen by him on a visit to Martinique last spring, and re-stated his belief that the new dome and spine are the solidification-plug of a previous eruption, pushed up to the surface during the series of eruptions that began in 1902. He considers this view to be proved by the coarsely-crystalline character of the fragments of the spine now to be found on the sides of the dome. The paper was illustrated with lantern-slides of new and old views. Dr. Tempest Anderson followed with an exhibition of lantern-slides from his photographs made on the Island of St. Vincent in 1902.

A timely paper was one by Professor A. C. Lawson of Berkeley on "The San Francisco Earthquake of 1906," in which were given the principal results thus far obtained by the State Earthquake Commission, of which he is chairman. The paper was illustrated by striking photographs showing the effects of the horizontal movement along the fissure which caused the quake, as well as the disastrous results of the vibrating motion in directions transverse to the fissure. Another timely communication, and on a subject not so familiar to American readers, was that by Dr. V. Sabatini of Rome "Sur la Dernière Éruption du Vésuve." The eruption was characterized by the enormous amount of ash and lapilli thrown out, which was thicker in a zone passing through Ottajano than it was either nearer the vent or farther away therefrom. The highest observed rate of flow of the lava streams was 66 meters per minute. It was estimated that 63,000,000 cubic meters of solid material were emitted by Vesuvius during the April eruption. Sand-flows like those of Pelé and mud-flows were noted. Dr. Sabatini's paper was illustrated with lantern-slides showing the main phenomena of the eruption, and was followed and supplemented by Dr. Tempest Anderson with a series of excellent stereopticon views of the same series of out-

bursts and their effects. In a paper entitled "Efemérides del Volcan del Colima," Presbyter S. Diaz of Guadalajara gave a résumé of continued observations of the outbursts of the volcano before, during, and after the eruption of 1903, and showed the great desirability of the establishment of a permanent observing station on that volcano. The other papers on the programme as read were: "Ueber den Verlauf der Geoisothermen in Bergen und seine Beeinflussung durch Schichtstellung, Wasserläufe und chemische Processe," by Professor J. Königsberger of Freiburg; "Interglacial Periods in Canada," by Professor A. P. Coleman of Toronto; "Geologic Classifications in the North Central Portion of the United States," by N. H. Darton of Washington; "Coon Butte, Arizona, its Meteoritic Origin," by Professor H. L. Fairchild of Rochester, N. Y.; and "The Western Sierra Madre of the State of Chihuahua," with lantern-slide illustrations, by Dr. E. O. Hovey of New York.

The International Committee on Glaciers reported through its chairman, Professor H. F. Reid of Baltimore, that the work of recording the movements and other phenomena of modern glaciers had been carried on systematically, and was being extended. No report was received from the "Committee on the Geological Map of Europe." The Committee on the Palæontologia Universalis reported through Professor F. Frech of Breslau that the work was being carried forward satisfactorily, and the Congress adopted his recommendation that the Committee expand the scope of its work to cover the republication entire of fundamental treatises in palæontology. Vacancies in the committee were filled by the election of Dr. R. Ruedemann for the United States and Drs. E. Böse and C. Burckhardt for Mexico.

The Committee on International Coöperation in Geological Investigations reported by letter through its chairman, Sir Archibald Geikie of England, that progress had been made toward conservation of energy along these lines. The Spendiaroff Prize was awarded to Dr. Th. Tschernyschew for his work entitled "Die Obercarbonischen Brachiopoden des Ural und des Timan." The following Committee was announced for the awarding of the prize for the next Congress: *Mexico,* Messrs. Aguilera (chairman), Böse, and Burckhardt; *United States,* Messrs. Osborn and Walcott; *Great Britain,* Sir Archibald Geikie; *France,* Professor Barrois; *Germany,* Professor Frech; *Austria,* Professor Diener; *Russia,* Dr. Tschernyschew. The theme proposed for the next competition for this valuable prize is "Description of a Fauna in connection with its Evolution and Geological Distribution." The suggestion of the Committee of Organi-

zation that the Congress publish an International Geological Review through subsidizing the Geologisches Centralblatt was referred by the Council to a Committee consisting of Messrs. Tschernyschew (chairman), Credner, Tietze, Low, Hayes, Barrois, Teall, Pellati, Aguilera, and Holm to report at the next Congress. The Council also adopted a strong recommendation to the next Congress that the excursions be confined to geologists, and elected a committee to formulate a plan for the more rigid supervision of matter offered for publication in the Compte-Rendu. The Congress adjourned to meet in Stockholm in 1909, or 1910, as may best suit the convenience of the Swedish committee.

The social side of the meeting was well cared for by the Mexicans. The evening before the beginning of the sessions was devoted to an informal dinner at the Chapultepec Restaurant, and the evening of the last day to a similar farewell dinner at Sylvain's Restaurant, in the city. Receptions were given at the Geological Institute, the Colonia Maria Club, and by the Minister of Fomento, an elaborate banquet was offered by the City of Mexico at the Municipal Palace, and a reception, followed by a dinner, was given by President Diaz in the Castle of Chapultepec. On the several excursions before, during, and after the sessions some twenty-five banquets were provided for the congressists on most lavish scale by Governors, municipalities, and mining men, and everything was done to make the foreigners feel at home and see all that could be seen in the time available of the geology and mines of the Republic. The Government, too, was practically the host of the Congress on the long excursions, since the fee paid by the participants was only about one-third the actual expense, the remainder being met out of the federal treasury. The Government also provided for half-fare rates for the congressists on all the railways of Mexico and for similar concessions on certain steamship lines from Europe, the United States, and South America.

The most important feature of the International Geological Congress is, probably, the excursions. In this respect the Mexican Congress was particularly good on account of the great variety which could be offered in the lines of vulcanology, tectonic geology, stratigraphy (particularly from the Upper Jurassic upwards), mining geology, and physiography, to say nothing of beautiful scenery, and all sorts of vegetation, from the scantily-covered desert and semi-arid upland to the dense tropical forests of the moist coastal plains of the Tierra Caliente. Ethnologists had several kinds of Indian tribes to observe; while for the persons interested at all in archæology the famous ruins were full of fascination. The rainy season was still

on during the period of most of the excursions, which added greatly to the difficulty of carrying out the programmes on account of delays due to soft track and washouts; but very few features of the whole long list were wholly lost. On the other hand, the showers cleared the atmosphere and rendered the mountains more beautiful.

Before the actual sessions of the Congress there were three excursions in south-central Mexico. The first party went to Oaxaca, examining *en route* the Archæan rocks of the cañon of Tomellin under the guidance of Dr. E. Ordoñez. From Oaxaca the great ruins of Mitla were visited, under the leadership of Professor E. Seler, the famous Americanist of Berlin. On the return to Oaxaca the party divided, most of the members hurrying back to Mexico City and thence to Morelia, to join either the Jorullo or the Colima excursion; so few of the original number were left, in fact, that the visits to the fossiliferous (Lower Cretaceous) localities of Zapotitlán and San Juan Raya were abandoned. The second excursion was to the volcano of Toluca, with Mr. T. Flores as leader, and to Jorullo, under the guidance of Dr. Ordoñez. Toluca is fourth in point of height among the mountains of Mexico, being a little less than 15,000 feet in altitude. Its crater contains one of the very highest bodies of water (elevation about 14,000 feet) in North America. The last phase of activity of the volcano was the exudation of a dome of lava within the crater which was too viscous to flow as a stream—the counterpart of the new dome of Mt. Pelé, Martinique. A few of the party climbed to the summit of Xinantihuatl, as the highest part of the rim of the volcano is called, and enjoyed thence a wonderful view of volcanic cones and craters, plains and woodlands, from the dense forests south and west of the peak to snow-clad Popocatepetl and Ixtaccihuatl in the east. From Toluca we went to the beautifully-situated, quaint old city of Morelia, where we joined the excursionists from the hot springs of Agua Fria and the extinct geysers of San Andres, who had had an interesting trip with Dr. P. Waitz as guide, but a very hard one, on account of heavy rains.

From Morelia the Jorullo party, under Dr. Ordoñez, was favoured by good weather and reported a wonderful trip, the members being particularly impressed by the view from the Hacienda Mata de Plátano across the Tierra Caliente to the Sierra Madre del Sur beyond the volcano of Jorullo. From Morelia the Colima party, under Dr. Waitz, proceeded without stop to Zapotlan, it being impracticable to visit the geyser region of Ixtlan on account of the heavy rains, which had rendered the trails impassable for a large

party of horsemen. At Zapotlan a day was lost on account of heavy rain in the morning; but Tuesday, August 28, the party was favoured by sufficiently good weather to make the start for the volcano, and the ten-hour ride through the forest over the pass of the Nevado de Colima to the camp at 10,800 feet elevation, fronting the volcano itself, was one never to be forgotten. The view from the pass includes the active cone (12,669 feet in altitude) and the Tierra Caliente below, quite to the Pacific Ocean at Manzanillo and westward. Fourteen of the party climbed to the top of Colima on August 29, and most of the number entered the old summit crater. This crater is filled with the block lava of the 1903 eruption, and through the crevices between the blocks live steam is issuing in such volumes that it would probably be impracticable to reach the top of the new cone within the old crater. The newspaper report regarding injury to the party was entirely without foundation in fact. On Toluca and Colima the geologists found that the State Governments had erected substantial log or slab cabins expressly for their protection against the cold nights, while the Congress guides had made every other provision for comfort.

All the excursionists assembled again in the City of Mexico on September 1, and the following day joined with new arrivals in starting upon the "Excursion to the East." The first day was occupied with the journey to Jalapa, the most interesting feature of which was the view of the recent volcanic phenomena of the Texcoco basin, in which lies Mexico City. The second day the party was divided into two sections, one of which went with Dr. Ordoñez as guide to the Cañon and Falls of Texolo, where is developed abundant electric power for use at Jalapa. The falls are double, consisting of an upper one of 50 feet and a lower of about 100 feet through a rift in the edge of a great flow of andesitic lava. A neighbouring gorge, 256 feet deep and less than 50 feet wide, cut through the same bed of andesite by the main river, is picturesque and interesting. The other section of the party, under the leadership of Dr. E. Böse, went to Carrizal, and there took horses for a ride through the barranca of Santa Maria Tatetla. Palæopliocene fossils were obtained by some of the party, but the principal interest of the day lay in the scenery and the dense tropical forest along the route. The third day was spent at Orizaba and in reaching the plateau again through the famous gorge traversed by the Mexican Railway. The tectonic features of the region were explained by Dr. Böse.

Four single-day excursions were offered gratuitously during the sessions. The first was, on September 7, to the extensive basalt

flow known as the Pedregal of San Angel, which is prehistoric as to recorded age, but which came from the region of Mt. Ajusco and overwhelmed human beings and covered pottery in its advance. On September 9 the congressists were the guests of the Geological Society of Mexico on a trip to Cuernavaca, where they were entertained by the municipality at a banquet given in the historic Palace of Cortés. The journey is one that is famous for the beauty of the scenery along the route. Tuesday, September 11, was devoted to visiting the prehistoric pyramids of the Sun and the Moon near San Juan Teotihuacan, where the members of the Congress were the guests of the Minister of Public Instruction and Fine Art. A highly-romantic feature of this day was the dinner given in the grotto "Porfirio Diaz," which is thought to have been excavated by the builders of the pyramids for material for those huge structures. The fourth excursion was given on Thursday, September 13, to the famous silver mines of Pachuca by the Compañia de Minas del Real del Monte y Pachuca, with a banquet at Pachuca given by the Governor of the State of Hidalgo.

Anything like a complete account of the great nineteen-day excursion through the northern portion of the Republic after the adjournment of the Congress would be too long for insertion in these pages, and only an outline sketch can be attempted. The congressists, to the number of 111, left Mexico City Saturday evening, September 15, in two luxurious Pullman trains. The trains were unusually heavy and the track very soft, so that their normal condition was that of being behind time. The first stop was at El Valle de Santiago, where Dr. Ordoñez conducted the party to some of the craters of explosion which characterize the valley. These are volcanic craters which seem to have been formed by single outbursts of steam. The following day, Monday the 17th, was spent at the famous old mining town of Guanajuato, which creeps up the sides of a great gulch and its tributaries four miles from Marfil, the nearest railroad station. Fabulous quantities of silver ore have been taken from the ground in this district. The Congress party was divided into three sections—one for surface geology under Dr. Waitz and two for mines under Messrs. Villarello, Flores, and Robles. It was quite a novel experience to walk down steps for a vertical distance of 800 feet into a mine (the Cata), and it was difficult to realize that for three centuries the only way of getting ore out of that mine was on the backs of men and up those long stone steps.

Tuesday was spent at the attractive little mining city of Zacatecas, where one section of the party devoted itself to the surface geology

under the leadership of Dr. C. Burckhardt and saw interesting series of fossiliferous beds of Upper Triassic age associated with schists of possibly greater antiquity and with diabase and intrusive and effusive acidic rocks (quartz porphyry). The Bote silver mine was visited by a group of the congressists, with Mr. Flores as guide. The next day the great lead-silver mine and smelter of Mapimí were seen, with Dr. Villarello as scientific leader. The ores carry much arsenic, and present some interesting problems in treatment, which are being handled in an up-to-date manner. The mines are deep for the country, being worked down to the 700-meter level.

Conejos was the next stop on the programme, and there, under the guidance of Dr. Böse, the party saw the surface geology and underground workings of the only known workable deposit of sulphur in the Republic. The sulphur is associated with a fault in the Cretaceous limestones and marls, and seems to be the result of hot-spring action rather than a reduction from gypsum. Friday, September 21, was spent in and near El Paso, Texas, the geological feature of the day being a reconnoissance of the laccolith and associated fossiliferous Cretaceous beds forming the Cerro de Muleros, with Dr. Böse as guide. Saturday was devoted to the city of Chihuahua, and Sunday to the mines and geology of the vicinity of Parral. Dr. Waitz led the party on the surface; while Dr. Robles led that which visited the Cobradilla silver mine, one of a great group of mines on the important "Veta Colorado," which lies between walls of rhyolite and related rocks.

Washouts prevented the party from going to Parras, and soft track and a washout delayed the trains so that the day was consumed in getting to Saltillo. Between Torreon and Saltillo portions of the Bolson de Mapimí that were said not to have known a drop of water for twenty-five years formed shallow lakes aggregating hundreds of square miles in extent. The three days, September 25-27, which were devoted to the horseback and foot trips from Concepcion del Oro to Mazapil and the Sierra de Santa Rosa formed a memorable part of the whole northern excursion. Study of the geology was under the guidance of Dr. Burckhardt, and included splendid examples of upturned and completely overturned Upper Jurassic and Lower Cretaceous strata and beautiful mineralized zones of the contact metamorphism between the limestones and a large intrusive mass of diorite. Along the contact lie the valuable oxidized and sulphide copper ores which are being exploited by the Mazapil Copper Co., whose mines were visited under the leadership of Dr. Villarello. Friday, September 28, was devoted to Las Esperanzas, Coahuila,

where the geological relations of the Upper Cretaceous exposures were explained by Dr. Aguilera; while the coal mines were visited, with Mr. E. Ludlow, of the Mexican Coal and Coke Co., as guide. The coal is of Upper Cretaceous age, and occurs in a bed about six feet thick in three basins near Las Esperanzas. It forms an excellent fuel—for a Cretaceous coal—and much of it is burned into coke. Saturday was spent at Monterrey, where the great smelter, the iron works, and the electric silver reduction plant were visited.

Sunday passed in travel, and Monday was devoted to the geology of the eastern edge of the plateau, from Cárdenas down to the coastal plain. From Cárdenas to Canoas the section was made on foot, with Dr. Böse as leader. The strata are of Upper Cretaceous age, and some of the beds are highly fossiliferous, so that many excellent specimens were carried away by the congressists. The ride from Las Esperanzas to Monterrey, and particularly that from Cárdenas through the Tamasopo and Micos cañons, were impressive in their display of the great thickness of Cretaceous limestone along the eastern portion of the plateau region and the amount of folding and faulting that the beds have suffered. The night was spent at Tampico, and on Tuesday the trains returned through the wonderful cañons, stopping *en route* to allow the passengers to go down into the picturesque Grotto of Choy, which lies directly beneath the railroad track in the limestone escarpment facing the wide coastal plain. A portion of the Congress party, led by Dr. Ordoñez and Mr. Doheny, stopped to examine the oil fields near Ebano, thirty-four miles west of Tampico. The wells are about 425 feet deep, and bring the oil up from Tertiary (Miocene?) beds. The oil is of very high specific gravity, with heavy asphaltic base. Only the gushing wells are utilized at present, and the production is about 1,500 barrels per day. Most of the oil is sold crude to the Mexican Central Railway for locomotive fuel. The remainder is refined, the distillates being sold to the Waters-Peirce Oil Co., and the asphalt being used for pavements in Mexico City and elsewhere. Wednesday was devoted to the smelter at San Luis Potosi and the city itself, and by noon of Thursday both trains had discharged their load of well-satisfied congressists in Mexico City.

Saturday morning, October 6, about sixty-five of the congressists left Mexico City for a visit to the Isthmus of Tehuantepec as the guests of Sir Weetman D. Pearson, the head of S. Pearson & Son, the great English firm of engineers and contractors having in charge the extensive improvements along the Tehuantepec Railway and the harbour works at Coatzacoalcos and

Salina Cruz, which have been provided for by the Mexican Government by appropriations amounting to about $32,500,000 gold during the past five or six years. Seven days were devoted to the trip under the scientific guidance of Dr. Böse, and the complete section across the isthmus was seen from the Pliocene of the Atlantic slope through the upper Miocene and the middle Cretaceous to the crystalline schists and the associated metamorphosed limestones of the heart of the "sierra" between Rincon Antonio and Chivela, the granitic and porphyritic rocks of San Gerónimo, the Archæan gneisses and granites of Tehuantepec and the granitic intrusive rocks of Salina Cruz. The excursionists were greatly impressed with the extent and completeness of the preparations made at both harbours and along the railroad for handling the enormous quantities of freight that are expected as soon as the route is thrown open to traffic on January 1, 1907.

The very end of the Congress was saddened by the death from typhoid fever on Sunday, October 14, of Dr. Franz Stradal of Vienna, Austria. Dr. Stradal was one of the younger members of the Congress, being only 27 years old, but he was a geologist of promise. He contracted the fever on the northern excursion, but he did not leave the party and go to the American Hospital in Mexico City until it was too late to save his life.

PHYSIOGRAPHY OF VIRGINIA.

BY

G. T. SURFACE, M.S.

The surface features are so closely connected with the geological history, and this in turn is so important in the determination of economic control, that we will discuss the physiographic phase from the view-point of geologic grouping and sequence. It is our purpose to give the reader a consistent portrayal of the Virginia land-mass at logical intervals during its physiographic evolution. The conclusions arrived at are based upon the most accurate information obtainable, in the absence of a complete topographic or physiographic survey of the State. As viewed from the standpoint of origin the land-mass divides itself into two major divisions: I. Appalachian Belt; and, II. Coastal Plain Belt.

APPALACHIAN BELT.—The classification recognized under this division is somewhat arbitrary, but we believe it is entirely in harmony with the similarity and continuity of geographic control, which centred about the original Atlantic land-mass until towards the close of the Mesozoic era.

(A). *Archaean system* of the Archæan period.

(B). *Taconic system* of the Middle Silurian period.

(C). *Appalachian system* of the post-Carboniferous period.

(D). *Palisade system* of the Jurassic period.

A. *The Archaean System.*

This represents the older Appalachian belt, or the Appalachian *protaxis,* which extends in a narrow peninsular band from Canada to central Georgia. It is continuous through Virginia, and the present exposure varies in width from 10 to 40 miles. It is probable that the materials of the Taconic and Palisade systems were deposited in valleys and bays which had been carved out of the Archæan land-mass, or in synclinal troughs formed therein by elevation and depression. This would indicate that the area extended farther eastward at the close of the period. The enormous amount of material supplied for the formation of the Appalachian system adds evidence to the same conclusion. We can form no estimate of the height of the land-mass, but all of the conditions lead to the belief that it was thoroughly mountainous in type, and probably varied from 5,000 to 25,000 feet in elevation. Even with this estimate, we must suppose it to have been a region of elevation during a part of the Paleozoic era to account for the immense sedimentary deposits of the Appalachian system. The region suffered re-elevation during the elevation of the Appalachian system, as shown by the west-northwest overthrust of the crystalline beds on the lower Silurian beds, and the intense metamorphism to which the rocks have been subjected. Since the thrust force which produced the newer Appalachians was from the southwest, the effect on the Archæan area must have been to increase the area along the western border and to make the topography more precipitous along the western flank of what might be designated the Piedmont Chain. The Archæan area was of sufficient elevation in post-Paleozoic time to effectually cut off the new Appalachian region from an eastward drainage. The region varies in elevation from 300 to 1,200 feet, increasing in general as we progress westward. The drainage is entirely into the Atlantic, and has a uniformly southeast direction. The

Potomac, Rappahannock, York, James, and Roanoke Rivers are the most important streams. They are *transverse,* in that they flow at angles to the direction of strike of the intricately folded and foliated structure; and they are *antecedent,* in that their position was fixed prior to the rejuvenation of the old topography.

The *watersheds* between the drainage systems are indistinct, which is characteristic of a region which has reached advanced maturity.

The valleys are usually narrow but productive, and the intervening ridges vary in productivity according to the conditions of previous cultivation, the nature of the underlying rock, and the degree of decomposition. The percentage of iron present is greatest along the western border.

Large beds of iron ore occur in the Archæan series. The rocks consist chiefly of granites, gneisses, syenites, diorites, gabbros, and various schists, and cover most of the region known as the Piedmont Plateau, which extends from the *Fall Line* (where the rivers emerge from the harder rocks of the inland on to the Coastal Plain) to the slope and crest of the Blue Ridge. These crystalline and metamorphosed rocks are believed to represent a part of the original crust of the earth, and to have been first elevated by the unequal contraction of the outer cooling crust on the inner molten mass. Most of the rocks weather easily by the decomposition of the iron, alkalis and phosphates, which, when entirely removed, leave a light sterile micaceous or sandy soil. The percentage of these elements left largely determines the productivity of the residual soils, which makes a chemical study of them very necessary for the intelligent application of fertilizers.

The present Piedmont topography is that of a dissected plateau upland, the seaward remnant of a broad, gently rolling surface, which once extended westward beyond the Alleghany Front, northward along the Appalachians into New York and New England, and southward across the Cumberland Plateau of Tennessee to an unknown distance. This peneplain condition of the Jurassic period was first described and studied by Professor W. M. Davis in Pennsylvania and New Jersey, and was named by him the *Schooley Peneplain.** Professor Davis describes the Piedmont Plateau in its present dissected stage as illustrative of the peneplain. "It is a peneplain, not monotonously smooth, but undulating in graceful swells, between gentle depressions."—(Davis.) Mr. Willis, of the United States Geological Survey, in his physiographic study of the

* Davis, W. M., "The Rivers of Northern New Jersey." National Geographic Magazine, 1890, vol. II., pp. 81–110.

Northern Appalachians, gave the name of Kittatinny Plain to this older base-level stage.*

B. *Taconic System.* (Middle Silurian.)

We will see under the discussion of the Appalachian System that at the beginning of the Paleozoic era there was being formed a great *geosyncline* along the western border of the Archæan land-mass. There was another geosyncline being formed at the same time along the eastern border. The indications are that there was a chain of these depressions, some of which were probably troughs of embayed synclinal valleys within the crystalline area. They were closely parallel to the Archæan *protaxis* and the Appalachian *geosyncline,* and extended from the region which marks the boundary between Canada, New England and New York, through Pennsylvania, Maryland and Virginia, and south-westward. These deposits thickened in the gradually sinking trough through the Cambrian and Ordovician periods, and at the close of the latter period were elevated into what has been called the *Taconic System.* The upturning resulted in great flexures and faults, and extreme metamorphism. The rocks present the same general characteristics as the Cambrian and Ordovician rocks of the Appalachian system, with the addition that the shales, sandstones and limestones are highly metamorphosed. The shales of Buckingham County have been definitely identified as belonging to theTrenton and Hudson epochs, and are a part of the Taconic series. The beautiful mottled brown and reddish brown marbles of east Tennessee belong to the same series (Hawkins and Knox counties). It continued a region of elevation, and therefore of denudation, through the Upper Silurian, Devonian, Carboniferous, Triassic and Jurassic periods, for no beds with marine fossils have been found over the area.

The series has suffered greatly from decomposition and erosion, which were facilitated by the crushing and disruption of the beds as caused by the violent crustal movements.

Great changes must have been wrought in the structure and surface features of the Taconic area by the forces which raised the Appalachian geosyncline into the towering *Appalachian Chain.*

The residual soils from the metamorphosed limestones are the most productive which occur in this belt. The shales and slates give rise to soils that are responsive to fertilizers and improved cultivation.

The streams cut across the strata as in the case of the crystalline series of the Archæan system.

* Bailey Willis—Physiography of the United States, p. 189.

C. *Appalachian System.*

Throughout the long Paleozoic era the material for the construction of the Appalachian system was in process of formation, at the expense of the surrounding crystalline area. These sediments were deposited in a great geosynclinal trough, in which the rate of subsidence was so nearly equal to the rate of deposition that almost the entire thickness was accumulated in shallow water. At the close of the era the crustal movements began, through which the strata were elevated and compressed into a series of parallel, inclined or overturned folds, with an elevation of 20,000 to 40,000 feet. In some places the overturned folds pass into *overthrust* faults. One of these in the southern Appalachians of Virginia represents a dislocation of 5,000 to 10,000 feet, by which the Lower Silurian limestone is brought in juxtaposition with the Lower Carboniferous sandstone. This fault so weakened the strata through crushing and disruption as to invite maximum erosion and decomposition, resulting in the removal of all the strata above the Silurian. H. B. Rogers pointed out that the lines of faults in Virginia are continuous with the flexures in Pennsylvania. The faults may therefore be designated as *flexure faults.* The structure of the Appalachians closely resembles that of the Alps. The thrust force, however, in the case of the Alps was toward the ocean, while that of the Appalachians was from the ocean. The pressure, being greatest from the ocean side, gave rise to asymmetrical and inverted folds, and the mountain ranges decline into an elevated plateau on the landward side, with feebly undulating or horizontal stratification. This is exemplified in the West Virginia Highland and the Cumberland Plateau of Tennessee. This high mountain region was worn down to an undulating plain (Schooley or Kittatinny peneplain) during the Triassic and Jurassic periods, with surviving ridges here and there of more resistant structure.

Towards the close of the Jurassic period the region was subjected to a moderate and gradual re-elevation, attaining a maximum in Virginia of 1,400 feet (Willis). The arch-lines follow the general strike direction of the Appalachian folds. This period of elevation rejuvenated the streams on the uplifted plain, making the valleys deepest where the elevation was greatest, and most shallow where the uplift was least. A revolution of the drainage system was initiated over a part of the region in the denudation attack along the lines of induced weakness. The change was greatest over the Appalachian region proper, since most of the dynamical agencies work more effectively on sedimentary rock structure. The excava-

tion of the valleys along the belts of weaker structure has resulted in a physiography more nearly approaching the mountain type than existed at the close of the re-elevation of the region. Most of the remnant ranges and the intervening valleys are the result of circum-denudation, the height of the ridges and the width of the valleys being the expression of the relative strength of the strata, and the amount of subsequent elevation. The *transverse* streams are contemporaneous with the larger *longitudinal* ones, but have only been able to carve out for themselves narrow valleys or precipitous gorges. From the standpoint of soil production they have added but little; but their economic value cannot be overestimated, since they have established natural locations for the great transportation routes across the Alleghany Mountains, and present ideal conditions for the most economic utilization of their superior water power.

The Appalachian *anticlinorium* has lost its physiographic identity, but it is readily revealed in a study of the structure as exposed by the stream dissection and surface denudation.

That part of the Appalachian System draining into the Atlantic Ocean is known as the Northern Appalachian, while the part south of New River, draining into the Gulf, is the Southern Appalachian.

The following subdivisions of the *system* are readily recognized in a topographic study: (1) Blue Ridge; (2) Valley; and (3) Appalachia.

(1) *Blue Ridge.* This stands out as the most prominent physical feature in the State. With an elevation of 1,460 feet at Harper's Ferry, where the Potomac breaks through the Blue Ridge, it increases southwestward, being 3,993 feet in Bedford County (Peaks of Otter), and reaches a maximum of 5,700 feet in Balsam Mountain, Grayson County, Virginia. This is a continuous barrier from the Maryland to the North Carolina boundaries, excepting four water-gaps and occasional wind-gaps. In its higher altitudes the crest line is marked by a hard, resistant sandstone of the Lower Cambrian period. The southern portion expands into a fan-like plateau, which is the watershed for the waters flowing into the Atlantic Ocean and the Gulf of Mexico. The counties of Floyd, Carrol, Grayson, Franklin, and a part of Montgomery are situated in the plateau portion. In North Carolina the plateau topography is intensified, and the elevation increases to a maximum of 7,000 feet.

The eastern flank of the Blue Ridge consists for the most part of highly metamorphosed Archæan rocks which formed the Paleozoic shore of the interior sea, and were thrust up by the great forces which gave birth to the Appalachian System. Along the crest, the

western flank, and the western foot-hills, the Cambrian rocks predominate. Well-identified fossiliferous shales of the Lower and Middle Cambrian occur near Natural Bridge, and at Balcony Falls (James River gorge through the Blue Ridge at Balcony Falls). So far as developed for minerals, this is the most unproductive region in the State.

(2) *The Valley.* This is a continuation of the Great Valley of east Tennessee, and becomes the Cumberland Valley in Maryland and Pennsylvania, the Kittatinny Valley of New Jersey, and the Newburg part of the Hudson River Valley in New York. It is the central part of the *Greater Appalachian Valley,* as described by Willis, which includes the Blue Ridge, the Valley, and the Alleghany Ridges. The Valley region is that which lies between the western base of the Blue Ridge and the eastern base of the Alleghany Front. It is 15 to 30 miles in width, and 310 miles in length, making an area of about 5,000 square miles. It consists of the following minor valleys: The Shenandoah, 106 miles; James River, 50 miles; Roanoke River, 38 miles; New River, 54 miles; and Holston River, 52 miles. For the purposes of convenience we may recognize three general sections: The *northern,* or Shenandoah Valley section; the *central,* embracing that region between the headwaters of the Shenandoah and the Holston Rivers, which is cut by the transverse valleys of the James, Roanoke and New Rivers; and the *southern* section, that part drained by the Holston River.

Viewed topographically, it is a broad, gently rolling plain, with the floor dissected by minor drainage systems. The elevation increases south-westward and westward, being 242 feet above tide at the mouth of the Shenandoah, and 1,687 feet where the Holston River crosses the State line. The maximum elevation of 1,700 feet is reached in Wythe County. The Shenandoah Plain was carved out of the *Schooley Peneplain* during the Tertiary period, and the subsequent elevation and denudation have brought it to its present topographic condition.

The soil of the valley is prevailingly limestone, and it is by far the most productive of the natural divisions. George Washington* realized its great possibilities when he wrote: "In soil, climate and production, in my opinion, it will be considered, if it is not considered so already, as the Garden of America."

There is no marked decrease of fertility as we pass from the bottoms to the uplands. The bottoms are utilized intensively and extensively for cultivation, and the uplands for grazing.

* Letter to Sir John Sinclair, 1796.

Settlements were made in the region as early as 1732. Several of the earlier ones were exterminated, but the natural conditions were so favourable that each depredation by the Indians inspired the settlers to stronger and more persistent resistance.

The position of the Valley topographically marks it out as a natural transportation route, so we find the Norfolk and Western Railroad traversing it from Bristol, which is on the Virginia-Tennessee line, to Roanoke; from this point the Shenandoah Valley extends to Harper's Ferry, on the Virginia-West Virginia-Maryland line.

(3) *Appalachia,* or *Alleghany Ridges.* This area embraces the region between the Valley and the Alleghany Front, which is the eastern border of the Alleghany Plateau, and is made of a series of ridges of northeast-southwest direction, alternating with narrow trough-like valleys. This general topography is interrupted where intersected by the transverse valleys, previously referred to. An examination of the ridges shows a remarkably accordant topography. They are believed to be the remnant of a plain of advanced topographic maturity formed during the Mesozoic era, which was continuous from Piedmont to the Alleghany Plateau, called by Davis the *Schooley Peneplain,* and by Willis the *Kittatinny Peneplain.* The region under discussion has been reduced to its present topographic condition since the Jurassic period by denudation and periods of elevation.

The ridges owe their elevation chiefly to the fact that the Carboniferous conglomerates and sandstones were depressed below the general level of the Kittatinny Peneplain, and thus escaped being worn away during the production of that feature. Subsequent elevation and denudation have removed the weakened anticlinal rocks, and left the synclinal remnants of hard sandstone standing out in relief, as protecting caps to the softer strata beneath.

Like the land of the Valley, the Blue Ridge and the Alleghany Front, these ridges increase in general elevation southward. Many of them exceed 3,000 feet. Elliot's Knob, 20 miles west of Staunton, has an elevation of 4,473 feet.

The Appalachia and Valley topography of southwest Virginia has been materially influenced by a series of faults which produced a displacement of 500 to 12,000 feet. The most important we may designate the *Saltville* or *North Holston* fault, with a maximum displacement of 10,000 feet; the *Walker Mountain* fault, with a maximum displacement of about 10,000 feet, and seemingly continuous with the *Great Fault* of Northern Virginia; and *Draper Mountain*

fault, which by a maximum displacement of 12,500 feet brings up the Lower Silurian in Wythe and Pulaski County as a rugged mountain in the heart of the Valley. Two cross-faults pass from it, the *Max Meadows* in a westward direction, and the *Pulaski* in a northwestern direction, toward the Walker Mountain fault; so that in the very heart of the Valley there is a block of Upper Silurian, Devonian and Lower Carboniferous, with Lower Silurian on two sides, Cambrian on the third, and Lower Carboniferous on the fourth.*

The soils of the upper slopes are usually sandy and sterile, being derived from the heavy siliceous sandstones and conglomerates. Beneath these strata occur the softer shales, some of which (the most calcareous) form fairly productive soils. The residual soils from limestone are always fertile, but most of the limestone strata have been removed by denudation.

Because of the very broken topography common to the region, it is best adapted to grazing. The narrow valleys are made up of sandy calcareous alluvium, with often a strong impregnation of iron, and are productive. Cultivation is concentrated on the valleys and lowlands.

More virgin forest survives in this belt than in any other part of the State, because of its inaccessibility. With the superior water power, which abounds throughout the region, the manufacture of hardwood products should become an important industry.

This is the most productive region of the State in mineral resources.

The bold south-eastward-facing escarpment of the Alleghany Plateau border constitutes the western border of the Alleghany trough. The State line is approximately marked by it, except in the southwest corner.

From Little High Knob (26 miles south of the Potomac in the Virginia-West Virginia boundary) southwestward it declines in elevation.

New River, flowing north-westward, enters the plateau in a cañon 1,500 feet deep. All the other streams crossing the Front rise in the plateau and flow southwestward, to emerge from deep cañons into the minor valleys of the Great Valley. This peculiar drainage adjustment was brought about by a southeastward tilting of the northern part of the plateau in the elevation subsequent to the Schooley Peneplain stage, while south of the New River divide the tilting was to the southwest.†

* American Journal of Science, 1887, p. 262.

† Russell, I. C., Rivers of North America, p. 205.

D. *Palisade System.* (Jurassic Period.)

At the beginning of the Triassic period it is probable that the Virginia land area extended farther east than it does at this time. During this period a series of narrow troughs was formed along the Atlantic slope, closely parallel to the trend of the Appalachians, as if occupying orographic valleys in the chain; but separated from them by the remnant ridges, which were still sufficiently high to effectually cut off the Appalachian drainage from the east. The depressions could not have been formed from an oceanic submergence, for no marine fossils have been found in the beds; neither could they have resulted from stream action alone, or the nature of the rock structure would be different. The most probable supposition, therefore, is that the depressions represent the topography of the continental border after the Appalachian upturning. The water accumulated in these depressions in estuaries, fresh-water lakes, streams, bogs and swamps, and the depositions took place slowly and to great depth. The rocks are mostly granitic sandstones, sandy shales, conglomerates, bituminous coal, along with carbonaceous shales. The extent of the conglomerate formation and the prevalence of the cross-bedded structure give evidence of the presence of strong currents.

The longest trough seems to have been continuous from the Hudson River south through New Jersey and Maryland, and into Virginia as far as Cumberland County, a distance of 350 miles. It is probable that the Richmond area was a separate basin, 35 miles in length; and that the Pittsylvania area belongs to the Dan River trough of North Carolina, 100 miles in length (40 miles in North Carolina). The thickness of the beds in Virginia varies from 2,000 to 3,000 feet.

Productive coal beds occur in the Richmond* basin south of the Chickahominy River, being northwest of the city of Richmond, and separated from the northern part of the Richmond Mesozoic area by an interval of crystalline rocks about 3 miles in width. This is the only Mesozoic area in Virginia which retains the basin form in its present structural condition.

The lateral pressure whch caused the elevation of the series was chiefly from the west, while that for the Appalachian system was chiefly from the east. The elevation took place at the close of the Triassic or in the early Jurassic period. Faults are frequent, and volcanic action became general, as shown by the numerous dykes which cut the series.

The crustal movements, however, over most of the region resulted

*U. S. G. S. Bull. No. 85, 1892; American Journal of Science, 1879.

in monoclinal uplifts of low angle. Flexures are rare and local, the largest being that of the Richmond Basin.

The Jurassic period was one of great denudation, when the high ranges of the Appalachians were much wasted away, and the newly-elevated Triassic beds were deeply eroded.

The brown sandstone of this series supplies one of our most valuable building stones.

COASTAL PLAIN.—At the close of the Jurassic period there was a slight elevation; but this was of short duration, and gave place to a strong eastward tilting of the land, which permitted the western transgression of the Upper Potomac formation.* The Potomac series was formerly classified as Lower Cretaceous by Davis† and others, but the very careful stratigraphic work of the Maryland Geological Survey has led to the classification of the lower beds of the series to the Jurassic. The Coastal Plain Series begins with the Potomac Group‡, which were formed in a narrow band along the Atlantic Coast. Detached portions of the beds indicate that they formerly extended farther westward. The different members of the Coastal Plain series were formed by alternate periods of elevation and depression. It is beyond the province of this discussion to enter into a detailed description of the geological history.

The series consists of sands, clays, loams and gravels, usually in the unconsolidated state, and arranged almost horizontally.

The Tertiary period was inaugurated by an encroachment of the sea, and the Eocene deposits of sands and clays formed in a narrow band through New Jersey, Maryland and Virginia. From Virginia southward the deposits become much broader. The crustal movements which closed the period were greater from south to north and from east to west, giving a southeast tilting. This is true for the whole Coastal Plain series, as evidenced by the thickness of the beds, and the resulting topography. One of the salient topographic evidences is the increase in the southeastward deflection of the streams along the western border of the Coastal Plain (along the "Fall Line").

The early Miocene witnessed a slight transgression of the sea, as a result of which the Upper Miocene beds were deposited on the Lower Eocene. By the close of the period the Atlantic and Gulf shores had attained almost their present outline.

A broad belt, extending from the Piedmont margin to the centre of

* Physiography of Maryland, Part II., p. 144.

† The Geological Dates of Origin of Certain Topographic Forms. Geol. Society America, Bull. II, 1890, pp. 545–548.

‡ Physiography of Maryland, II, p. 121.

the Coastal Plain, is covered by a mantle of Lafayette (Pliocene) deposits in the interstream area. These consist of clay, loam, sand and gravel, the latter being often ferruginous and cemented into a compact ironstone. The formation has an average thickness of about 50 feet.

With the close of the Tertiary the Atlantic Coast was raised about 100 feet in the Virginia portion. On passing from Piedmont to the Coastal Plain, the stream character changes abruptly from rapids, falls, and steep gorges, to meandering streams over a terrace-bound lowland. The terraces were formed by the flood-plain condition existing during the Pleistocene period.

The great number of bays and estuaries are of comparatively recent origin, having been formed by the gradual subsidence of the Coastal Plain region, by which the rivers were drowned in their lower course through the transgression of the ocean. The Susquehanna River formerly entered the ocean east of Cape Henry, and the Potomac, James, York and Rappahannock were its important tributaries. The continued depression converted the lower Susquehanna Valley into the Chesapeake Bay, and embayed the mouths of the lower tributaries, making them tidal streams. Accomac and Northampton Counties became thereby separated from the mainland.

The effect was to make all of the important streams navigable in the Coastal Plain part of their course, and it gave to the State in the formation of Hampton Roads (estuary at the mouth of the James River) the finest American harbour.

The elevation increases from sea-level to 150 feet on the western border. From the surface configuration the land is commonly designated as *first* and *second bottom*, and the *ridge country*. The *first bottom*, where protected from the tide, is very productive. It is in this portion that most of the swamp and marsh lands occur, all of which are covered with a variety of swamp and marsh grasses, which are partially utilized for grazing. Wherever this has been reclaimed it is exceedingly productive, Dismal Swamp* being the most notable example. No survey or special study has been made of these wild lands, but there is no doubt but that hundreds of square miles could be reclaimed at a cost which would leave a wide margin of profit.

The *second bottom* is alluvial, as the *first*, and is the most valuable part of Tidewater. The subsoil is a dark red or yellow clay, with a moderate admixture of sand. The surface soils consist of sandy loams, which vary in colour and consistency according to the

*Dismal Swamp marks the southern limit of the bog mosses (Sphagnei) which are common further north, and the northern limit of the dwarf palmetto.

mineral and vegetable matter predominating. The *ridge country* has an elevation of 90 to 150 feet above sea-level. The soil is a light sand, easily eroded, and intractable to most methods of improvement. This section represents one of the most important economic problems in the State. Calcareous marls have proved very beneficial, and it is believed by some fertilizer authorities that most of the area can be brought into a state of at least fair productivity.

Emory and Henry College, Emory,
Virginia.

DR. ROLLIN A. HARRIS' THEORY OF THE TIDES.*

BY

G. W. LITTLEHALES.

In a manner characteristic of a master of the facts of observation in relation to the tides and as the author of forms of computation for the analysis and classification of tidal records which constitute the greatest advance in practical tidal work since the introduction of the harmonic analysis, Dr. Harris has addressed himself to the task of outlining a tidal theory which shall account for the tides as they are actually observed to exist in nature. His preliminary studies of the causes of the tides led him to attempt to mark out in the oceans and other bodies of water such areas, or systems of areas, as are capable of independent oscillation in the same or nearly the same period as the tidal forces have, and in which it is possible for the tidal forces to cause the tide to mount up to a considerable amplitude; and then to obtain theoretical results with reference to these areas, under the supposition that the tidal forces are distributed over the waters of each system and that the times of elongation of the water particles are thus determined with reference to the tidal body. Having compared these theoretical results with the observed values, he announced that in most cases the dominant ocean tides have their origin in definite systems whose free periods of oscillation are very nearly those of the tidal forces, and that the time of high or low water in each is the time when the virtual work of the tidal forces upon the system becomes zero.

For the semi-diurnal tides, the systems pointed out are seven in

* Manual of Tides. Part IV A: Appendix No. 7—Report for 1900; Part IV B: Appendix No. 5—Report for 1904. } Coast and Geodetic Survey, Washington.

number, comprising the North Atlantic, South Atlantic, North Pacific, South Pacific, North Indian, South Indian, and South Australian. For the diurnal tides there are fewer systems. A system may comprise several regions of comparatively simple form, styled oscillating areas. If these areas could be partitioned off, each would have its free period of oscillation approximately equal to the period of the tidal body. From the tides thus produced are derived both stationary and progressive waves.

This is the keystone of the arch upon which is built the new explanation of the tides as they are found to exist in reality, and it is doubtless a doctrine that will prove to be of permanent value as an agency for advancing to a complete treatment of the actual causes of the tides. Philosophers have held that the tides of the ocean advance westward, tending to follow the moon in its apparent diurnal course in the heavens; and, according to this teaching, a westerly progression would be especially looked for in the southern seas where a continuous zone of water encircles the earth. But, as a matter of fact, there is a remarkable eastward progression in the South Pacific Ocean, and, as an illustration of the rational bearing of the author's theory, it may be said that this eastward movement is directly traceable to the boundary conditions surrounding the South Pacific oscillating system.

It is probable that the author was brought to recognition of the necessity for the existence of oscillatory motion sustained by the tidal forces by realizing the smallness of the effect of the forces demanded by the equilibrium theory in comparison with the ocean tides as they are known to be, and thus seeing that tides as great as the actual ones could only be produced by successive actions of the tidal forces upon systems, of such a nature that they would preserve the general character of their motion during several successive periods of the tidal body if the forces of attraction were to cease their action.

Of tides occurring in natural bodies of water, those most easily understood occur in bodies so small and deep that the equilibrium theory applies. To such cases Chapter I, Part IVA, is directly applicable, as are certain sections in previous parts of the Manual, notably §§38-40, 42, Part I, and §§49, 50, Part II. For instance, we see (§3, Part IVA) that for a body of water not too shallow, lying under the equator and extending 172 sea miles east-and-west, the amplitude of the mean lunar tide at either end would be 0.08 foot; high water at the east end would be simultaneous with low water at the west end, and *vice versa*. The central meridian would constitute a nodal line along which there would be no rise and fall. For such

a body of water situated in any other latitude, the rise and fall at each end would diminish as the cosine of the latitude, while there would be some rise and fall on the south and north shores of the body. And so for any latitude north or south of the equator, a lake-like body will not possess a nodal line but a no-tide point. This point is the centre of gravity of the surface, and from it the cotidal line must radiate as straight lines.

The force diagrams, Fig. 1, Part IVA, furnish a ready means of computing the amplitude and time of tide for any small body of water whose depth is sufficiently great for causing its free period of oscillation to be but a small fraction of the period of the semi-daily or daily tidal forces. The equilibrium theory applies reasonably well to such bodies of water as Lake Superior, and the eastern portion of the Mediterranean Sea. On account of the expanse of the oceans, the water surface cannot arrange itself normal to the tidal forces in the period of a half day or a day, and so cannot obey the equilibrium theory. It is desirable, however, to have means of ascertaining the theoretical amplitude of the tide and the cotidal lines for bodies less extended than oceans, yet so large that the curvature of the earth's surface cannot be ignored; and §4, Part IVA, shows how such cases can be treated.

Chapter III, Part IVA, is devoted to a discussion of free oscillations in bodies having various geometrical forms. It illustrates the contour lines, including the nodal lines, and lines of motion, and shows how depth, horizontal dimensions, and period are related. The modes of oscillation obtained for a few simple areas have a much wider application than is at first evident; for if a thin, vertical wall be put in the place of any line of motion, the character of the motion will not be affected; and so a great variety of forms can be readily discussed. Chapter V supplements Chapter III, by experiments upon small bodies of water.

Chapter VI treats of small oscillations sustained by periodic forces, and has special reference to the prevailing ocean tides. The smallness of the equilibrium effect of the direct action of the tidal forces, if applicable to the oceans, can be inferred from the value already given for small bodies; which amounts to saying that the slope upon which the surface of the water temporarily lies when the maximum disturbing forces are acting in equatorial regions is, for the mean moon, only 0.017 of a second, or one vertical unit to about 12 million horizontal units. The equilibrium amplitude of tide for a deep body 1,720 sea miles long would not be ten times as great as the amplitude for a body 172 miles long, but something less, even if the

body were entirely enclosed by land. With the imperfect boundaries, and the prevailing ocean depths, it is evident that equilibrium tides must be small. The observed magnitude of the tide shows the necessity of oscillatory motion sustained by the tidal forces; and so the effect of a number of successive impulses is represented in any particular tide. For simplicity, canal-like areas are chiefly, but not exclusively considered. The body of water is supposed to be given in position, as upon a chart, and the forces, or local force arrows, of the diagram, Fig. 1, are readily found for any assumed Greenwich component hour. These are supposed to be properly scattered over the oscillating body and the times of elongation of the particles, *i. e.*, the times of high or low water at that loop, thereby determined.

Chapter VII consists of applications of the theory to the tides. In addition to the theory already developed numerous lemmas are laid down, which the conditions of the natural bodies of water require. Here the fundamental systems, shown in the world-charts designated as Figure 23 and 24, accounting for the dominant tides in nature, are pointed out and briefly described. Evidence of nodes and loops, or approximations to these, is also cited. In laying down these oscillating areas, certain requirements have to be filled at least approximately, *e. g.*, the free period as calculated by the body's horizontal dimensions and depth must approximate quite closely to the period of the tidal forces; if rectangular, the areas must be a considerable portion of a wave-length in width, and the more defective the lateral boundaries the broader must be the rectangle, in order that the forces may produce sensible tides.

Chapter VIII deals with tides in rivers, straits, bays, etc., its object being to explain some of the more local features of the tides.

Part IV$_B$ of the work is chiefly devoted to the descriptive and cartographic representation of the cotidal lines of the world, deduced in conformity with the theoretical considerations which have been unfolded as a means of obtaining a first approximation to the times of the principal ocean tides, and justified by the use of richer and more varied observations and a wider knowledge than have ever before been brought to bear upon this subject. The charts of cotidal lines are thirty-six in number, and relate to all parts of the seas of the world. The lines have reference to the *mean luni-tidal interval* and not the interval at *full and change* of the moon nor to the *M2 interval*, and the ranges given are *mean* or *average ranges* and not ranges at spring tides.

Upon referring to the world-chart of cotidal lines, it may be noticed that there are several points situated in different parts of the

world around which the tidal hours are represented to progress, completing a cycle of values in the period of the tidal oscillation. These are no-tide points, or places where the range of tide is nothing; and the regions in which they occur are called amphidromic, on account of the radiating cotidal lines having a cycle of values. They are caused by the overlapping of systems, by progressions due to secondary or dependent bodies of water into which a free wave progresses, and by the necessity for a gradual change between adjacent regions whose tides are not simultaneous; and they constitute a characteristic innovation in this great work, among whose chief fruits must be the benefits that will come from pointing out before the world, in a manner so orderly, the avenues of investigation and observation along which the further advancement of our knowledge of the tides is to be approached.

Nov. 23, 1906.

GEOGRAPHICAL RECORD.

AFRICA.

A Letter on African Languages.

EDITOR BULLETIN:

SIR: The importance of language in relation to political and social aspects of the native question in Africa seems liable to be overlooked. The possibility of large groups of tribes, hitherto distinct and mutually antagonistic, becoming rapidly able and eager to understand each other in some common form of speech has apparently to be taken into account. Twenty-six years' contact with Swahili and various dialects of Eastern and Central Africa points so far to the conclusion that there is a remarkable degree of similarity, amounting in many important respects to substantial identity, in the grammatical structure of language over the whole vast area occupied by the Bantu races of Africa, from the Soudan to the Cape. And the stock of words common to all Bantu tribes, when recognised under their various dialectic disguises, will probably prove very considerable.

The Officials, Missionaries, Traders, Settlers and Travellers of various nationalities who are qualified to give help in testing this conclusion by personal and first-hand study of a Bantu dialect are naturally difficult to reach,—scattered in remote and often isolated spheres of work. It is, therefore, perhaps justifiable to ask publicity for the request, that persons so qualified and willing to accept and reply to a brief communication on the subject would send me their addresses at Fort Jameson, North Eastern Rhodesia. I should be grateful if foreign

journals and local papers in Africa, general and official, would assist by calling attention to my invitation.

I am, etc.,

(sgd) A. C. MADAN,
(Student of Christ Church, Oxford.)

c/o The British South Africa Company,
FORT JAMESON,
NORTH EASTERN RHODESIA.
12th July, 1906.

A STUDY OF THE SEBU RIVER, MOROCCO.—In the last month of 1905, Lieut. Dyé of the French Navy, commanding the hydrographic mission to Morocco, and E. Pobeguin made a survey of the middle course of the Sebu River, taking soundings, studying the *régime*, and also the life of the people along its shores and the products of the fertile plain. Mr. Pobeguin has a paper on the river in *La Géographie* (No. 4, 1906). The Sebu rises somewhere in the Atlas ranges, flows past Fez, and empties into the Atlantic. Though many travellers had seen the river, our knowledge of it was meagre, for only a few intrepid men—Tissot, Fischer, and Capt. Larras—dared to attempt any surveys in the valley.

The writer says that the Sebu is without doubt the most important river of northwestern Africa. Watered by rains in winter and by melting snows in summer, its discharge is quite regular in quantity. It flows in numerous meanders over an alluvial plain which is an ocean of verdure. In the distance are snow-covered mountains. No marked depression of the surface indicates the river from a distance, but its position is shown by the line of fig trees growing on the banks. The trench in which the river flows is bordered by banks of fertile alluvium from twenty to forty feet in height. The river, unseen till the traveller stands on its edge, is in one place rapid and with many sharp bends, and in another it widens, and the lower course is gentle and comparatively straight.

The Beni Hassen, who live along the muddy banks of the left shore, have a bad reputation, which they seem to deserve. Many of them have been driven across the river by their southern neighbours, the Zemmurs, and the fugitives have driven the peaceful farmers along the right bank from the fields. The continual difficulties between the frontier tribes and the fact that both banks are infested with brigands make the journey anything but agreeable. The tribes are always fighting one another. They are armed with rifles, and their principal means of living is the theft of each other's cattle. The Christian traveller is, of course, regarded as a tempting victim. The French explorers often found it necessary to open their baggage in order to convince the people that the boxes were not full of money.

The natives were much disturbed by the efforts to take soundings, and even more by the work of triangulation. The explorers were finally compelled to give up canoeing on the river. In spite of the fertility of the country, it may be many years before we shall see the Sebu except at Mechra el Kçiri, the ford on the route from Larache to Fez, or perhaps at Hadjer el Ouâqenf, the ford on the route from Tangier to Fez.

WORK OF THE SURVEY DEPARTMENT OF EGYPT.—In his *Report* on this work in 1905 (Cairo, 1906), Capt. H. G. Lyons, Director General, says that the chain of triangulation from the Mediterranean along the Damietta branch of the Nile and up the Nile Valley as far as Wadi Halfa is completed. From Cairo southward

this forms a network, covering all the cultivated land; while to the north about two-thirds of the delta have not yet been triangulated with sufficient accuracy, but this work is now in hand. With the completion of the triangulation in Upper Egypt the cadastral survey progressed rapidly, and a very large out-turn for the year brought within sight the completion of the mapping of the cultivated lands of Egypt for revenue purposes. With the completion of Beni Suef province in the latter half of 1906, the whole of the cultivated land of Egypt will have been surveyed on the scale of 1:4,000 or 1:2,500 and the maps of all excepting the provinces of Sharqia, Beheira and Beni Suef will have been printed and published.

Floods in the Congo Basin.—Mr. Leo Frobenius, in his fourth paper on his travels in the Kassai basin (*Zeitsch.* of the Berlin Geographical Society, No. 7, 1906) says that the rainfall was extraordinarily heavy in the upper part of the Congo basin early in 1906. No European there had ever before seen such a rise in the waters of many of the tributaries. Villages were overwhelmed, and a great part of the riverine life was transformed into lagoon life. The natives built platforms in their huts or near them, on which they took refuge, and boats were the means of communication between the settlements.

Permian Glaciation in South Africa.—Professor W. M. Davis has recently published a full statement of his physiographic observations made during attendance upon the recent British Association Meeting in South Africa.* This paper contains much interesting description of that region and comparison of the conditions there with those in North America. A part of the paper is devoted to a statement of the remarkably clear evidence of Permian glaciation, closing with a discussion of the possible causes for this glaciation. These glacial conditions were not those of local valley glaciers, but of the continental type, and the deposits are spread over an area just outside of the Torrid Zone, the source of the ice being from the north—that is, from a region nearer the equator. Professor Davis points out that there is good evidence that this region was not one of great altitude at the time, and that under present conditions of latitude and distribution of wind systems it is exceedingly difficult to account for this phenomenon of glaciation. He shows that changes of land area or land form appear ineffectual as an explanation of glacial conditions here, and that "No conceivable arrangement of continents and ocean currents could produce an abundant snowfall in latitude 25 degrees, so long as the general temperature of the atmosphere preserved its present values."

An interesting part of Professor Davis' discussion is the inclusion of a serious consideration of a possibility of an actual shifting of the poles. He states that "If a change in the position of the axis took place in Permian time, it would seem easy thus to account not only for the Dwyka glacial formation of South Africa, but also for the Talchir glacial formation of northwestern India, and for the Muree glacial formation of southeastern Australia." He further brings forward the evidence against shifting of the poles and concludes in the following words: "The shifting of the poles is therefore at present not only a daring hypothesis, but gratuitous and discredited as well. Nevertheless, if evidence of Permian warm climate were found around a zone that would be equatorial to an Indian Ocean polar area, and if another Permian glacial area were found in the regions antipodal to the Indian Ocean, this daring, gratuitous, and discredited hypothesis would have to be taken seriously into account.

* Bulletin of Geol. Soc. of America, Vol. 17, 1906, pp. 377-450.

"The cause of the Dwyka glaciation for the present remains a puzzle, although the effect of the glaciation is well established."

It is true, also, that the cause of the Pleistocene glaciation is, though a fact, a puzzle. It is likewise true that a change of the poles would account for the phenomena observed. Geologists generally have been rather chary of even entertaining this hypothesis—first because there is no known cause for such a change, and, second, because there is no evidence of the disturbance in the crust, which it is believed would necessarily follow such a change, by the adjustment of the equatorial bulge to a shifting axis. It requires such a remarkable phenomenon as continental glaciation in a subtropical region to lead to a serious consideration of the possibility of a change in the earth's axis, and there are many who, though this hypothesis is "daring, gratuitous, and discredited," will be inclined to give it serious consideration. R. S. T.

Gold in the Transvaal in 1905.—Since the resumption of mining operations at the end of the war between Great Britain and the Boers in 1901, the value of the annual product has steadily increased until the gold output of the Transvaal again surpasses that of any other region. According to the *Report* of the Government Mining Engineer (Transvaal Mines Department), the gold yield in 1905 was worth $104,272,200. Mining was resumed in May, 1901, and the total yield of gold from that time till the end of last year was $289,550,500. During the second half of 1905, the yield per ton of ore crushed, not including gold contained in by-products not treated at the mines, was 34.91 shillings a ton. Including the gold estimated to be contained in products sold the total yield per ton crushed was 35.19 shillings. At the end of last year the labourers employed in gold production in-included 18,159 whites, 93,831 negroes, and 47,267 Chinese.

Condensation from Clouds on Table Mountain.—Observations have been made on Table Mountain, South Africa, in order to ascertain the amount of water due to the deposit of moisture from southeast clouds on the surface of vegetation as distinguished from the actual rainfall. Gauges screened by reeds were employed, and showed that the amount of water which reached the gauges during long periods of southeast clouds was far in excess of the total rainfall for the corresponding period. The gauge with reeds collects more water than an ordinary gauge during any ordinary rain; but the most marked difference occurs during misty rain, showing that the vegetation is effective in capturing moisture apart from the real rain.—(*Geogr. Journ.*, XXIV, 96; *Trans. So. Afr. Phil. Soc.*, XVI, 1905, pt. II.) R. Dec. W.

AMERICA.

Annual Report of the New Jersey Geological Survey for 1905.—Mr. Kümmel reports that the sales of maps to the public showed a marked increase in 1905, particularly in the case of the large-scale sheets, the increase being nearly fifty per cent. This increase has been made in spite of the competition of the U. S. Geological Survey, whose maps are much cheaper than those of the State Survey. The Survey used considerable mineralogical and geological material during the year in making thirty collections of 170 specimens each of rocks, minerals, fossils, and ores for distribution to the high schools of the State.

Among the papers is one by Prof. Lewis M. Haupt on recent changes along the New Jersey coast, in which he records several instances where remedial works, constructed at great expense, have utterly failed to accomplish the desired

end because of improper design or location. He also presents good evidence to show that by properly-constructed jetties, so shaped and placed as to guide the currents in desired directions, the action of tidal scour may be made effective to remove bars and keep channels open.

Mr. C. C. Vermeule discusses at length the project of transforming the low, flat country along the Passaic River above Little Falls and as far as Chatham into a lake and reservoir, for the prevention of floods in that river. The survey has been procuring data for definite answers to the questions involved. Thus far, the most desirable flow-line is indicated at an elevation of about 190 feet, which would make the area of the proposed lake 33,536 acres.

SALT INDUSTRY IN OHIO.—A recent publication of the Geological Survey of Ohio (4th Ser. Bull. 8, by Prof. J. A. Bownocker) furnishes material for an excellent illustration of the influence of the distribution and development of natural resources upon the distribution of industries.

In the pioneer days of Ohio, salt springs in southeastern and eastern Ohio were the only sources of salt in the State. These wells were not rich in salt, but flourished (1) because of the local imperative demand for the product—a demand which could not because of distance and difficulty of travel be well supplied from New York; (2) because of the cheapness and abundance of local native fuel in the adjacent forests and coal seams; (3) and, rarely, because of the recovery of valuable by-products, as bromine and calcium chloride, the latter for land-dressing.

Some salt works prospered above others (1) because of market advantage, usually in near-by towns (notably true of the Morgan County works, which shipped by river to Zanesville), (2) because of greater richness of brine, and (3) because of cheaper fuel. Many passed into disuse when the brine became weaker, when fuel became exhausted, or when competition arose with wells having saturated brine. Six plants still continue; five in and near Pomeroy persist because of the cheapness of fuel (coal dug from the foot of the hills near-by), and one at Durant, because of a large near market at Zanesville, and in spite of some difficulty in getting coal. In the case of the five plants the saving of the by-products helps to make the business profitable.

Competition came from the rapid expansion of the industry in Michigan and in New York, and later in northeastern Ohio. The latter began in 1889, on the discovery of saturated brines at Newburg, and later at Cleveland, Kenmore, Wadsworth, and Rittman. The plants at these localities are shown to have geographic advantages, as follows, which seem to insure their continued prosperity: (1) While fuel is not as cheap as in southeastern Ohio, coal, either local or near, provides plenty of fuel at reasonable cost; (2) The salt is very abundant, accessible, and is obtained in almost or quite saturated brines; (3) markets in the cities and all through this more densely-populated region are excellent; (4) transportation facilities to distant points are excellent; (5) dependent industries have sprung up near the salt plants. Fertilizer-making, glazing, soda, and soap-making are among the consumers of the products of the salt industry.

Thus while the early industry could only supply local needs, the extensive development of the richer deposits in the northeast has practically crushed out the weaker industry in the southeast, and has brought to its side several industries which use its products and in turn stimulate the development of the fundamental industry.

G. D. H.

Good Roads in Indiana.—Most of the *Annual Report* for 1905 of the Department of Geology and Natural Resources of Indiana is devoted to the question of good roads. In 1902, the Department began to study the location and quality of road-material deposits in each county of the State. The present Report, containing the result of this investigation, shows that Indiana is abundantly supplied with road materials, and that they are well distributed, as only eight or ten counties will have to import gravel or stone. In the northwest corner of the State both gravel and stone are lacking or are deeply buried under the drift. In the southwest corner and the greater part of Pike, Posey, Vanderburg, and Warrick counties, the drift-line is to the north and the sub-carboniferous limestones are to the east, so that they lack both gravel and stone suitable for road use.

It is unfortunate that the excellent reports of this Department are illustrated by so many maps of poor quality. Many of the maps in the *Report* for 1905 are inferior to the average newspaper map.

Areas in the United States.—The question, "What constitutes the area of the United States?" is discussed in Bulletin 302 of the United States Geological Survey, written by Mr. Henry Gannett. Jurisdiction extends to a line 3 nautical miles from the shore, but this strip of sea cannot properly be regarded as a part of the country. Supposing our country to be restricted to the sea and lake coast, there remains a question regarding the bays and estuaries. To what extent should the coast-line be followed strictly; and where should we begin to jump across the indentations made by the sea? In this matter one can only follow his own judgment, making in each case as natural a decision as possible, as no definite criterion can be established. The absence of an absolute standard is in large measure the cause of the discrepancy between the tables of the Census Office, made in 1881, and those of the General Land Office, prepared in 1899, both of which show the areas of the United States and of the several States and Territories.

The measurements and computations upon which these tables were based were made with great care and thoroughness in each case, and the results probably represented the areas as closely as they could be determined from the maps and charts in existence at the time. Most of the differences in these two sets of tables are trifling, amounting to only a few square miles or a small fraction of 1 per cent., being well within the limits of error of the planimeter and of the maps used. Some of them, however, are considerable, and a few are explained by the fact that more recent maps, which changed the position of boundaries between States, had been used by the Land Office, and its measurement was, therefore, more nearly correct. Other discrepancies arose from differences in determining the coast-lines.

Realizing the desirability of but one Government statement of areas of the States and Territories, an attempt has been made by Mr. Frank Bond, chief draftsman of the General Land Office, Mr. C. S. Sloane, geographer of the Census Office, and Mr. Henry Gannett, geographer of the Geological Survey, to come to an agreement on these figures. The results of their conference and co-operation are set forth in the aforementioned bulletin.

By this adjustment the area of the United States proper, which is given as 3,026,789 square miles, is increased over the Census Office figures by 1,188 square miles.

The area given for Alaska is 590,884 square miles. It is subject to considerable modification in the future as the position of the coast-line becomes better known. The area given for the Philippine Islands is 115,026 square miles, and

was determined by the Coast Survey of that archipelago, prepared at the instance of the Philippine Census. It is also subject to modification by accurate charts of the archipelago. The areas of Hawaii, 6,449 square miles, and Porto Rico, 3,435 square miles, are probably subject to only slight changes, as the charts from which they were measured are quite accurate. The areas given for the other small possessions of the United States—Guam, 210 square miles, Samoa, 77 square miles, and the Panama Canal strip, 474 square miles—will probably be changed in the future as their limits become more correctly defined.

PRODUCTION OF COAL IN 1905.—Mr. Edward W. Parker, statistician of the U. S. Geological Survey, reports that the production of coal in this country in 1905 reached 392,919,341 short tons, valued, at the mines, at $476,756,963. Both in quantity and value these figures surpass all our previous records. Of the total production 77,659,850 short tons were Pennsylvania anthracite, valued, at the mines, at $141,879,000. The total production of bituminous coal and lignite was 315,259,491 short tons, valued at $334,877,963. The total production of this country last year was nearly 50 per cent. larger than that of Great Britain, which, until 1899, was the leading coal-producing country of the world. The total increase in the production of coal in the United States in 1905 over 1904 was larger than the production of France in 1904 or of any other foreign country excepting Great Britain, Germany, and Austria-Hungary, and was almost equal to the production of Austria-Hungary. Since the United States began to mine coal, the output has been practically doubled in each decade.

STATISTICS OF U. S. RAILWAYS FOR THE YEAR ENDING JUNE 30, 1905.—The annual report of the Interstate Commerce Commission for this period shows that the total single-track railroad mileage in this country was 218,101 miles, or 4,196 miles more than at the end of the previous year. The aggregate length of railroad mileage, including tracks of all kinds, was 306,796 miles. The railway equipment included 48,357 locomotives, and 1,842,871 cars of all classes (passenger service, 40,713 cars; freight service, 1,731,409; and company's service, 70,749 cars). The number of persons on the pay rolls was 1,382,196, which is equivalent to an average of 637 employees per 100 miles of line. The number of passengers carried was 738,834,667, and the number of tons of freight carried was 1,427,731,905.

GEOGRAPHIC DICTIONARY OF ALASKA.—The second edition of this useful work has been issued as *Bulletin* 299 of the U. S. Geological Survey. The first edition, which appeared in 1902, contained about 6,300 names and 2,800 cross references; the present volume has about 9,300 names and 3,300 cross references. This large increase in the nomenclature is striking testimony to the rapid growth of the Territory in industrial importance. Many of the names are those of new mining towns, camps and mineral fields; many others have been obtained by explorers and surveyors while carrying out fresh geographical work, and others have come from the native tribes or from old settlers, miners, prospectors, pilots and fishermen.

The plan of the dictionary is to give alphabetically all the published names which have been applied to geographical features in Alaska. This includes obsolete as well as current names. It aims to show the origin, history, modes of spelling, and application of each name, and in the cases of Indian, Eskimo, and foreign names their meaning also. And finally it shows, in bold-face type, the forms approved by the United States Geographic Board. Rejected, doubtful, and

obsolete forms are printed in italic. Elevations are given when known. The work is brought down to about 1905. One of the most interesting features of the bulletin is a list of the principal authorities used in the preparation of the dictionary.

An Item in Panama Commerce.—Two species of marine turtle furnish the tortoiseshell of trade. One of these (*Eretmochelys imbricata*), the hawk's bill turtle, is found only in the warm waters of the Gulf of Mexico and the Caribbean Sea. It is mostly carnivorous, and so is valued, not for its flesh, but for its shell alone. The animal is caught in the water by means of nets, or alongshore by over-turning, when it lands at night to deposit its eggs in the sand. The shell is removed in successive layers, rubbed with fine sand and then sold. Some five to seven pounds of commercial shell are derived from each turtle, and the price ranges from $3.00 to $6.00 in gold, per pound. Because England pays the best price the largest shipments go there, but a considerable amount, which enters the trade by barter with the San Blas Indians through the coasting schooners, comes to the United States. The total amount of tortoiseshell shipped from the consular district of Colon in 1905 is estimated at 16,000 pounds and valued at about $70,000, gold. For the fiscal year ending June 30, 1906, $11,219 worth was shipped from Colon to the United States.—(*Mo. Cons. Report, Aug.*, 1906.)

G. D. H.

ASIA.

The Desiccation of Asia.—Mr. Ellsworth Huntington, whose recent work of exploration in Asia, first as a member of the Pumpelly Expedition and later as a member of the Barrett Expedition is well known to geographers, has brought back what he believes to be conclusive evidence that during the last 2,000 years there has been in progress a desiccation of Asia. This matter is no new one, for many explorers in this same region have previously come to the same conclusion. Mr. Huntington, however, has matched up the evidence of tradition, historical record, topography and archæology in a more thorough way than did any of his predecessors, and his conclusions therefore carry more weight. The evidence brought forward by Mr. Huntington in a recent paper on "The Rivers of Chinese Turkestan and the Desiccation of Asia" (*Geogr. Journ.*, Oct., 1906) is of various kinds. The rivers appear to be withering; for dead vegetation is found in several cases beyond the present reach of the waters, indicating a retreat recently of 50 to 60 miles. A former greater size of certain streams is also indicated by old channels now in process of being filled with sand. Thirteen of seventeen of the larger rivers have on their lower courses the ruins of towns which date back a thousand years or more. Where there are ruins of various ages, the older lie farther downstream, and are so far out in the desert or on rivers so small or saline "that it would be impossible again to locate towns of equal size in the same places unless a far better system of irrigation were introduced." On the Endere River there are ruins of three towns of different ages, which apparently grew up one after the other, the later town in each case being smaller than its predecessor. There is water enough to-day for a large town, but it is too salt to use. In another case, on the Vash Sheri River, the former larger population "could not be supported to-day without a radical change in the system of irrigation." The lake of Lob Nor agrees with the rivers, showing signs of having been larger at no very distant date, but there is evidence also of expansion in the past, as well as of contraction.

The phenomena of rivers, springs, lakes, ruins, and vegetation all seem to Mr. Huntington to point to a gradual desiccation of Chinese Turkestan. The area of desiccation extends from the Caspian Sea eastward for over 2,500 miles. This increasing aridity he, in common with Prince Kropotkin and others, thinks must have been effective in inducing emigration of the inhabitants to other more favoured lands. R. DEC. W.

AUSTRALASIA.

The Royal Geographical Society of Australasia, founded in 1885, recently celebrated at Brisbane its twenty-first birthday by a festival extending over four days. The Society has published twenty-one volumes of Proceedings and Transactions, of which "about 80 per cent. are original contributions to geographical literature, the remainder being the result of research work in contradistinction to mere compilations."

EUROPE.

COAST EROSION IN GREAT BRITAIN.—The question of protecting the British coast from the attacks of the waves is now receiving serious attention in Great Britain. Two papers upon this subject, read before the last meeting of the British Association, are published in a recent number of the Geographical Journal.* In these papers it is shown that the coast-line of Great Britain is very materially different from that of its condition when the island was invaded by the Romans under Julius Caesar in the year 55 B. C. It is also shown that in many places the coast-line is receding rapidly, while in others deposits are filling up the indentations. The chalk cliffs of Flamborough Head, eighty to one hundred and thirty feet in height, are receding at the rate of a foot and a half a year. In other places, where the cliffs are lower and made of unconsolidated glacial deposits, the annual recession amounts to as much as three to five yards. Lowestoft Ness (Suffolk), the most easterly point in England, consisting of glacial drift, receded 1,100 feet between 1854 and 1901—that is, at the rate of 23.4 feet a year. There is also an outward building of some of the wave-made forelands. For example, Dungeness Point (Kent) has advanced at the rate of seven yards a year between 1689 and 1844, according to one authority. The Trinity House records show that the seaward advance of this point was at the rate of nine feet a year beween 1792 and 1850; thirteen to fourteen feet between 1850 and 1871; and eight feet between 1871 and 1897. The lighthouse on this point has been shifted seaward three times during the last century. The great mass of shingle deposited to form this point is indicated by the fact that at a distance of 100 yards from the shore, the water is four fathoms in depth at low tide, and at a distance of 330 yards, fifteen fathoms. R. S. T.

A CARTOGRAPHICAL MUSEUM AT GENEVA.—A letter received from Switzerland says that Mr. Charles Perron, the cartographer who drew all the maps and plans for Reclus in his *Nouvelle Géographie Universelle*, has organized a Cartographical Museum in Geneva, the nucleus of which is formed by the fine collection of maps that Reclus accumulated while writing his work, and which Mr. Perron used in compiling the maps. The collection has been presented to the city of Geneva on the suggestion of Mr. Perron, and the city has given several rooms in the University library for their accommodation and has appointed Mr. Perron

* Vol. 28, No. 5, 1906, pp. 487–495. By Clement Reid and E. R. Mathews.

as curator. He was also engaged last summer in preparing a separate exhibit illustrating the history of cartography down to the seventeenth century.

Mr. Perron has also constructed a relief model of Switzerland, which is exhibited in the upper hall of the University. The photographic reproduction of it, sold in map form, is a striking representation of Swiss orography.

VARIOUS.

HINTS TO TRAVELLERS.—The Royal Geographical Society has recently issued the ninth edition of "Hints to Travellers" under the editorship of Mr. E. A. Reeves. This publication, which has been of great value to explorers in all parts of the world, grew out of a small pamphlet produced many years ago under the direction of Mr. John Coles, long the map curator of the Society. From this modest beginning the book came to be the most important manual of the kind in English; and as the needs of the explorer are changing with the great advance in research, Mr. Reeves has endeavoured, in the new edition, to meet some new demands.

He says that as the days of the pioneer explorer are drawing to a close and more exact surveys are now required, many alterations have been made in the first volume and much new matter has been introduced. The aim has been to secure a higher standard of exactitude, and some of the astronomical methods which were merely approximate have been omitted. There are still travellers, of course, who might do very useful survey work by the old approximate methods, and the editor tells them how they may replace the omitted tables and instructions. The first and larger volume is entirely devoted to surveying and practical astronomy, and the second volume has the usual sections revised and brought up to date and a new section on Archæology written by Mr. D. G. Hogarth. The work continues to be a condensed treatise of the highest value to travellers.

EFFECT OF CLIMATE UPON SPEECH.—In Col. L. A. Waddell's book, "Lhassa and its Mysteries," he makes this novel observation upon the possible effect of low temperatures on speech:*

> One curious result of the cold should be mentioned here, namely, its effect upon the speech of the people. A peculiarity of the language of the Tibetans, in common with the Russians and most Arctic nations, is the remarkably few vowels in their words, and the extraordinarily large number of consonants; for example, the Tibetan name for Sikhim is "Hbrasljongs." Indeed, so full of consonants are Tibetan words, that most of them could be articulated with almost semi-closed mouth, evidently from the enforced necessity to keep the lips closed as far as possible against the cutting cold when speaking.

The Geological Survey of Ireland has been placed under the charge of Professor Grenville A. J. Cole, Professor of Geology in the Royal College of Science, Dublin.

---

* Col. Waddell darkens counsel by words without knowledge. The Russians are not an Arctic nation. It is true that the territory of Russia extends to the Arctic Ocean; so does the territory of the United States and so does the Dominion of Canada. Are the Canadians and the Americans Arctic nations? It is a popular delusion that the Russian language is overburdened with consonants. Of the 36 letters in the Russian alphabet 12 are vowels and 3 are semivowels. If Col. Waddell will take the trouble to count the vowels in a printed page of Russian he will probably see a great light.

It does not appear why the inhabitants of Arctic regions find it more easy to utter their mind in consonants than in vowels, and some of them certainly do not. The speech of the Eskimos shows a full proportion of vowels.

The *Athenaeum* (No. 4125) says that many years ago Sir Clements Markham, the British geographer, became convinced that the period which witnessed the change of dynasty from Plantagenet to Tudor had been misrepresented. His new book, "Richard III: his Life and Character reviewed in the Light of Recent Research," is the result of his historical studies. The author's conclusion is that Richard III must be acquitted on all the charges brought against him in the Tudor stories.

La Nature reports that the Prince of Monaco is arranging for a first International Conference on Oceanography and Marine Meteorology, to be held, if possible, at the time of the inauguration of the Museum of Oceanography.

GEOGRAPHEN-KALENDER FOR 1906-1907.—The latest edition of this annual has a new feature—a geographical chronicle for 1905 by Prof. Paul Langhans, in which a wide variety of events of interest in geographical circles is set down in chronological order. The items include dates of the deaths of geographers, boundary treaties, great storms, landslides, earthquakes, military and political events, etc. The chief events in the field of exploration are summed up by Prof. Langhans by continents in eleven pages. Prof. H. Haack covers the geographical literature of the year surprisingly well, though, of course, not completely, in 101 small pages. This annual compilation has already won a place as one of the most convenient and helpful of the bibliographies. Dr. Haack also compiled the obituary list, covering 71 pages, with biographical information. The latest editions of the Address Books, (B) "Lehrstühle, wissenschaftliche Anstalten und Gesellschaften der Erdkunde und verwandter Wissenschaften," and (C) "Geographische und verwandte Zeitschriften," will save time, and conveniently serve many geographical workers. In Address Book B the notices of scientific establishments and societies are given under an alphabetical arrangement of the towns in which they are situated; but as some societies have no fixed abode, information concerning them appears in an appendix to the list. The map supplement contains 16 maps relating to recent geographical events.

Dr. J. Gunnar Anderson has been appointed Director General of the Geological Survey of Sweden, in succession to Dr. A. E. Törnebohm, who retires.

Dr. Sven Hedin, to whom the Indian Government denied access to Tibet across the frontier of India, is reported to have entered Western Tibet from the northwest through Chinese Turkestan.

A hint for societies publishing bibliographies at periodical intervals may be derived from the *Jahreshefte* for 1906 of the Verein für vaterländische Naturkunde in Württemberg. The volume concludes with a bibliography (50 pp.) of the literature in 1905 relating to the earth studies in Württemberg, Hohenzollern, and the neighbouring regions. A paper strip pasted around this section informs the bookbinder that it is not to be bound with the volume, but is to be kept till the next Annual shall appear, when the bibliographies for the years 1902-1906 are to be bound together, making a convenient volume of reference to the literature of these subjects for five years.

TRANSACTIONS OF THE AMERICAN GEOGRAPHICAL SOCIETY, NOVEMBER AND DECEMBER, 1906.—A Regular Meeting of the Society was held at Mendelssohn

Hall, No. 119 West Fortieth Street, on Tuesday, November 20, 1906, at 8.30 o'clock P. M.

Vice-President Tiffany in the chair. The following persons, recommended by the Council, were elected Fellows:

Frederick W. Weston.	John Shrady.
Henry A. Spangler.	C. Arthur Moore, Jr.
Elmer E. Wolfe.	Gino C. Speranza.
Bertram Gordon Waters.	Charles W. Wetmore.
J. F. Vale.	John A. Schlener.
Edward S. Thurston.	George D. Hubbard.
William Edgar Geil.	John Barrett.
John Hubbard.	F. W. Prentice.
Curtis H. Veeder.	James Wallace Van Dusen.
Charles Glatz.	Walter B. Mahony.

Francis J. Higginson.

The Chairman then introduced Mr. Richard Arthur, who addressed the Society on a Yacht Voyage of Ten Thousand Miles: Round the West Indies and Up the Amazon. Stereopticon views were shown.

On motion, the Society adjourned.

At a meeting, held on the 15th of November, 1906, the Council awarded the Cullum Geographical Medal to Dr. Robert Bell, for Fifty Years' Exploration in the Dominion of Canada; and

The Charles P. Daly Medal to Dr. Thorvald Thoroddsen for his geographical and geological work in Iceland, and his History of Icelandic Geography.

A Regular Meeting of the Society was held at Mendelssohn Hall, No. 119 West Fortieth Street, on Tuesday, December 18, 1906, at 8.30 o'clock P. M.

Vice-President Tiffany in the chair. The following persons, recommended by the Council, were elected Fellows:

G. R. Agassiz.	Beverly Chew.
William H. Andrews.	Charles Scribner.
Charles E. Berner.	C. H. Stuart-Wade.
George F. Crane.	Adolphe E. Borie.
Samuel H. Bishop.	Daniel A. Davis.
William Armstrong Crozier	Rosa Welt Strauss.
William S. Champ.	Rowland Hazard.
Herbert M. Cowperthwait.	Robert Emmet Farley.
Thomas Darlington.	Paulding Farnham.
William C. Damron.	Cecil C. Evers.
Charles B. Barkley.	Alexis I. DuPont.

The Chairman then introduced President Peary, who addressed the Society on the Field Work of the Peary Arctic Club, 1905 to 1906.

Stereopticon views were shown.

On motion, the Society adjourned.

THE ASSOCIATION OF AMERICAN GEOGRAPHERS.—This Association will hold its third annual meeting at the house of the American Geographical Society on Monday and Tuesday, Dec. 31 and Jan'y 1, holding morning and afternoon sessions,

and an evening session on Monday. The programme will include the reading of papers by members, some of which will be illustrated by lantern-slides. The BULLETIN is requested to announce that the Association extends a cordial invitation to the members of the American Geographical Society to be present at its meetings.

NEW MAPS.

AFRICA.

ERITREA.—Schizzo dimostrativo delle Vie di Comunicazione fra l'Eritrea, il Sudan, e l'Etiopia. By Carlo Rossetti. Scale, 1:5,000,000, or 78.99 statute miles to an inch. *Atti* del Congresso Coloniale Italiano in Asmara. (September–October, 1905, Vol. 1, Rome, 1906.)

An excellent map showing railroads in operation and construction, wagon and caravan roads, the commercial zone of Asmara, etc. The network of routes extends from Suakin in the north to Addis Abeba in the south, and from Jibuti in the east to Khartum in the west. This is probably the completest route map of this part of Africa.

MOROCCO.—Plaine du Sebou. Carte Levée en 1905. Par la Mission Hydrographique du Maroc. Scale, 1:100,000, or 1.5 statute mile to an inch. *La Géographie*, No. 4, 1906. Paris.

The map illustrates a paper by E. Pobeguin on the reconnaissance of the Sebu by the Dyé Mission in 1905. It is a reduction from the survey on a scale of 1:10,000, and comprises the middle part of the river between Mechra and Kçiri and Sibi bel Kheir. Fords, settlements, and trigonometrical stations are given.

AMERICA.

U. S. GEOLOGICAL SURVEY MAPS.

UNITED STATES.—Geologic Atlas of the United States, Washington, D. C., 1906. No. 140, Milwaukee Special Folio, Wisconsin. Scale, 1:62,500, or 0.9 statute mile to an inch.

The area mapped and described in this Folio covers the greater part of Milwaukee Co., and extends about a mile into Waukesha Co. The Folio contains descriptive text, topographic map, areal geology map and illustration sheet.

ALASKA.—Grand Central Special Map.

ALASKA.—Nome Special Map.

These are two of the special topographic maps of parts of Alaska, revised to April, 1906. Special surveys and maps are made of districts that, for mining or other reasons, are attracting particular attention.

U. S. HYDROGRAPHIC OFFICE CHARTS.

Pilot Chart of the North Atlantic Ocean, December, 1906.

Pilot Chart of the North Pacific Ocean, January, 1907.

UNITED STATES.—Soil Map of Newton County, Indiana. Scale, 1:63,360, or one statute mile to an inch. U. S. Department of Agriculture (Bureau of Soils), Washington, D. C., 1906.

Illustrates the soil survey of Newton Co., in the northwest corner of Indiana, bor-

dering on the Illinois State line. Eleven distinct soil types were recognized and mapped in this area. Each of the types was found to be quite distinct, and the line of demarcation between the soils is generally quite well defined. This map is like many which the Dutch produce of their flat country, and shows one excellent use to which cartography may be applied in regions where there is little topographic relief to be expressed.

ILLINOIS.—A Provisional Geologic Map of Illinois. Scale, 1:760,320, or 12 statute miles to an inch. Bulletin No. 1 of the Illinois State Geological Survey, Urbana, Illinois, 1906.

The map was compiled by Stuart Weller from published and unpublished data, no field studies having been undertaken in connection with the work. It is a digest of material already at hand and available, and will serve as a base upon which to make corrections as the survey progresses. The location of shipping coal mines is indicated, and columnar sections for northern, central, and southern Illinois are printed on the margin.

ILLINOIS. Map showing Oil and Gas Fields of Southeastern Illinois. Scale, 1:506,880, or 8 statute miles to an inch. Bull. No. 3, Illinois State Geological Survey, Urbana, 1906.

The map illustrates a paper by W. S. Blatchley on "The Petroleum Industry of Southeastern Illinois." Deposits of oil and gas of commercial importance were discovered in 1905. The oil and gas fields are shown in red.

CANADA.—Thunder Bay, Lake Superior. Scale, 1:120,000,or 1.8 statute mile to an inch. Bulletin No. 16, U. S. Lake Survey Office, Detroit, 1906.

Prepared from the recent Canadian surveys covering this region. Thunder Bay is a fine sheet of water on which Port Arthur and Port William are situated. Most of the bays along the northern coast of Lake Superior have not yet been accurately surveyed, and must be navigated with great care.

UNITED STATES.—Vicinity of Sault Ste. Marie, Michigan and Ontario. Scale, 1:15,000, or 1,200 feet to an inch. Bulletin No. 16, U. S. Lake Survey, Detroit, 1906.

Shows the American and Canadian canals. St. Marys Rapids and other unnavigable waters are shown in blue, and the ship canals and adjacent navigable waters in white.

ASIA.

MALAY PENINSULA.—Map of Central Section of Malay Peninsula. Scale, 24 statute miles to an inch. Accompanies Supplement (Map and Itinerary) to Fasciculi Malayenses. Longmans, Green & Co., London and New York, 1903.

A good map by Bartholomew prepared from the latest surveys of the Malay Peninsula and illustrating the explorations of N. Annandale and H. C. Robinson in 1901–1902. The explorers added the positions of villages in the interior and of the jungle tribes that they visited.

INDIA.—Railway System of India. Scale, 1:5,068,800, or 80 statute miles to an inch. Administrative report on railways in India for 1905. Simla, 1906.

The map is corrected up to April 30, 1906. Railroads are coloured to show those in operation, under construction, or sanctioned, and the gauge of each. Insets show the railroad terminals in Bombay, Madras, and Calcutta. The total mileage in India is 28,295.

INDIA.—Burma. Scale, 1:6,000,000, or 94.6 statute miles to an inch. Jahresbericht der Geographisch-Ethnographischen Gesellschaft in Zürich, 1905–1906. Zürich, 1906.

A series of four black-and-white maps illustrating a monograph by Dr. Hans J. Wehrli on the "Industrial Geography of Upper Burma and the Northern Shan States." The maps show the boundaries of the districts and their capitals, meteorological stations, the annual distribution of rainfall, the distribution of rice and other crops, and the density of population.

EUROPE.

HUNGARY.—Niederschlagskarte des Theissgebietes, 1891–1900. Scale, 1:2,000,000, or 31.56 statute miles to an inch. By P. Vujevic. *Geographische Abhandlungen.* Vol. 7, No. 4. Leipzig, 1906.

A black-and-white map of the Theiss basin with seven symbols to show the quantitative distribution of rainfall. The maximum precipitation is in the N. E. Carpathians, the source region of the Theiss, the Lower Tatra, and in the Siebenbürgen plateau lands and mountains.

POLAR.

ANTARCTIC.—Expédition Antarctique Française. Commandée par le Dr. Charcot. Scale, 1:2,800,000, or 44.19 statute miles to an inch. *La Géographie*, No. 5. Paris, 1906.

Illustrates a paper by Dr. Charcot on the scientific results of his expedition of 1903–1905. The west coasts of Graham Land and Danco Land and of the neighbouring islands which Dr. Charcot surveyed are distinguished from those previously outlined.

ATLASES.

ATLAS OF THE WORLD'S COMMERCE.— Compiled from the latest Official Returns at the Edinburgh Geographical Institute. Edited by J. G. Bartholomew. (Parts 14 and 15.) George Newnes, London, and Frederick Warne & Co., New York, 1906. (Price, 25 cents a part.)

Coloured plates show the mean annual rainfall with limits of snowfall, the prevailing winds, distribution of climatic diseases, density of population, distribution of white, yellow, and black races, of religions, of the ten chief languages of commerce, and a double-page Mercator map showing the various degrees of commercial development. Mr. Chisholm's "Introduction to Economic Geography" is included in Part 14 and a Commercial Gazetteer of the countries and ports of the world with black-and-white maps of leading ports is begun in Part 15.

BOOK NOTICES.

Otfried Nippold, Ein Blick in das europafreie Japan. Frauenfeld, Huber & Co., 1905. 56 pp. 8vo.

The title of this little pamphlet is somewhat unhappily chosen. The author means to speak of those sides of Japan which are uninfluenced by European culture —*i. e.*, chiefly the domestic and inner life, the philosophy and the leading ideals. That European culture conquered Japan merely in its technical aspects, and is nothing but an outward polish, which never affected very deeply the hearts of the Japanese

people, was never doubtful, and it is a fact by no means to be deplored. The paper is a popular essay, pleasantly written for the enlightenment of the public, in regard to the real conditions of modern Japan, and exhibits those slight, erroneous conceptions to be found in all authors who are not familiar with the country through a personal visit; as may be seen, for instance, by his remark on p. 7 that there are no tailors and seamstresses in Japan; or by that on p. 9, where he mentions that both sexes bathe together, which custom was forbidden decades ago; but as he draws from reliable sources, chiefly Rein, Rathgen, Chamberlain, Hearn, and some Japanese authors, he is in general fairly correct. At the end, Nippold submits the question of the world-mission of Japanese culture to a brief discussion, and gives it as his opinion that the influence of the sound mental forces of Japan upon "our culture, somewhat decrepit and evidently incapacitated in many regards," would be beneficial, and should be hailed with honest joy. We fully concur with the author in his judgment, but dissent from him in his prophecy that th's moral influence will be felt only at some future time, when Japan shall have created her political and economical position, because we believe that this influence has been in full force and been making rapid strides forward for a long time, as evident to any impartial observer by many palpable symptoms. What our author designates as "Japan free from Europe" is simply the ideals of Chinese civilization, on which the greatness of Japan rests; these and the ideals of the West represent nowadays the two great contrasting and struggling principles in the world's civilization. If the final victory of the white race over the peoples of the globe was once doubtful, it is so now more than ever before, and it is now left to the white race to reform and to regenerate itself by learning from the ideals of the East, or, if not, to cede its seeming and merely visionary supremacy to the East Asiatics, which would not be a calamity, but a blessing for the furtherance of the good cause of true civilization, in which the Japanese doubtless are now taking the lead. A mutual fertilization between our own culture ideas and the highest ideals of the East, and an amalgamation of the substance of the leading principles of the two culture spheres, might finally result in a superior form of cultivation, in a higher concept of the standard of living, in a more intimate, more artistic growth in the conduct of life, greater, perhaps, than we should now ever venture to realize. B. L.

Baron Suyematsu, a Fantasy of Far Japan; or, Summer Dream Dialogues. London: Archibald, Constable & Co., 1905. 337 pp. 8vo.

Written in the form of dialogues, in a graceful, conversational style, this book is very well suited to while away an idle hour or two in pleasant company with as much profit as enjoyment. In the atmosphere of a Parisian salon, with the verve and esprit of a Frenchman, the baron talks freely and fluently, with the attitude of a man of the world, on the notions and ideals of his country; naturally, these causeries are not very deep, but they are always entertaining and instructive; to all questions put to him by his interlocutors he has something interesting to say and worth while listening to, especially in the comparisons which he draws between Japanese ideas and our own. He thus defines, for example, the difference between the notions of our mediæval and of Japanese chivalry of the Samurai (p. 42): "With your chivalry the custom of rendering respect to the fair sex had been carried to such a high pitch that it was nothing less than adoration or worship. I do not say the motive was originally bad, because it came no doubt from the idea of helping the weaker. But, remember, it often happened that too much prominence was given to keeping faithfulness to women, even where one had some higher duty which ought to have claimed the whole loyalty of his heart. The subject is rather too delicate for me to describe minutely, but you

can see what I mean. In the days of your chivalry faithfulness in love affairs was looked upon in general as gallantry, no matter whether the affair was honourable or otherwise; but with the Japanese Bushido it was different. It was not because a Bushi was heartless toward the weaker sex, but effeminacy was a thing which he despised most. In the days gone by in Japan, if a Bushi had been found paying too much attention to a lady, and making himself a slave to her, to the neglect of his duty, he would have been hooted out of society. With European chivalry, therefore, the tendency of desire was to be noticed by others for his actions performed in homage to a lady, whilst with our chivalry one would try to do his utmost to conceal his emotion, and even to look cold. In the West, therefore, the word 'gallantry,' which was originally used more for 'dashing and noble bravery,' came in common parlance to have quite a different meaning, as you know. Nothing of the sort has ever taken place with us." And, further: "There was also another great difference. In the West chivalry had grown and decayed, traversing always pretty much the same line; I mean it had undergone no great transformation. But in Japan the case was somewhat different. There it became united with the art of intellectual learning, and has made Bushido, that is, the ways of Bushi, more systematic and ethical . . . Broadly speaking, I can say that in the West friendship or affection moved more towards intimacy, whilst in the East it moved more towards respect." Valuable from a scientific point of view is his discussion, then, of the history of the term *bushido* (p. 103 *et seq.*), which, in his opinion, is by no means modern, as usually accepted by foreign scholars, but occurs as early as in the middle of the Twelfth Century in an historical record, the Hogen Monogatari. In the fourteenth century an ethical doctrine for Bushi was expounded by Shiwa Yoshimasa, a Japanese general (1349–1410). Since 1608, when Bushido made great systematic progress on its literary and intellectual side, many treatises on the subject have been written by eminent scholars.

Interesting are also his judgments on Lafcadio Hearn (pp. 74–76, p. 86), of whom he remarks, not quite unjustly, that he tried to reason out some points of Japanese life which are not altogether to be explained by ordinary reasoning, as entirely resting on the spirit of feeling and sentiment. He finds, also, that Hearn lays too much stress on the notions of ancestral worship, the extent and bearing of which the reviewer thinks is usually overrated.

To the charge of untruthfulness frequently thrust upon the Japanese, he replies, much to the point, as follows (p. 116): "This kind of charge is the commonest method which the Occidentals employ when they talk about the character of other races, which they generally regard as inferior to themselves. But mere common-sense will tell them that that there can be no human community, even amongst undeveloped tribes, where the word *lie* is not a word of reproach, if only the smallest element of a moral notion exist; and there can hardly be any human community where there is no such moral notion at all." As regards the general moral conditions, he is inclined to think that, taken as a whole, the social structure of Japan is, in reality, far cleaner than that of most countries (p. 117), but that she was even better in that respect in the days gone by (p. 118); on the whole, the morality of the individual was higher in the old days, because those days were more simple, and the community more sober; the more primitive a land is, the better it is morally. People were happy in former days, because they did not know what freedom meant; still less the enjoyment of the luxuries to which they are now accustomed. To them ignorance was literally bliss. But the idea of happiness, nowadays, differs in kind and character; and it is difficult to say if modern Japan is as happy as the ancient Japan (p. 123).

The Baron does not believe in the desirability of intermarriages between foreigners (p. 159). There have been, of course, he argues, many intermarriages between the Japanese and the Occidental races, and the results of some of them have apparently been very good. But there have also been many failures; and he does not think, in general, that happiness can be secured by intermarriages of this kind so much as by those between people who have greater resemblance to each other in customs and manners and everything else. Even if the couple are happy, it often happens that it is not so between them and their relations.

There are several useful appendixes treating of the political organization of the empire, education, Anglo-French diplomacy in Japan forty years ago; sketches of some chief figures in Japan of to-day; a speech by Marquis Ito made in Washington 34 years ago; commercial morality of the Japanese; Japan and foreign capital; the languages of China and Japan, once more on Japan and France, Japan and Europe, the Indo-China question, the Australian question, the Anglo-Japanese alliance and America. It will be readily observed that this is the book of a many-sided, thoughtful writer, who is not wanting in topics, in questions, and answers. B. L.

Lantern Illustrations for the Teaching of Meteorology. Edited by Henry J. Cox and J. Paul Goode. Bulletin of the Geographic Society of Chicago, No. 3. 8vo. 1906. Pp. 130.

In 1905 the Geographic Society of Chicago undertook the task of collecting a set of lantern-slides for use in meteorological teaching, and appointed a committee to take charge of the work. On this committee, in addition to Professor J. Paul Goode, then president of the Geographic Society, were Professor Henry J. Cox, in charge of the Chicago station of the United States Weather Bureau; the chief observer of the same station, and three teachers. The committee has completed its work, and has selected a set of 270 lantern-slides, which it is selling at cost price. In connection with the slides there has been published a *Bulletin* giving an adequate description of each slide, together with a list of books and other materials for use in teaching, and two general papers, an introduction by Professor Cox, and a paper on the use of the lantern in teaching, by Professor Goode. The slides, which cover all the subjects usually included in general meteorological instruction, consist of maps, diagrams, photographs, etc., and were selected from the large number of available illustrations in the *Atlas of Meteorology*, in recent text-books, in meteorological journals, and the like. They also include a considerable number of photographs, as well as of weather maps and weather records, which were prepared by the committee. These slides will prove of great and lasting value to all teachers of meteorology. The Geographic Society of Chicago, and especially Professors Cox and Goode, deserve and will surely receive the hearty thanks which are due them for their painstaking and wholly unremunerative labours. And meteorological teaching in the United States will be given a further, a most effective, and a much-needed stimulus. We regard this publication, with the slides, as one of the more important American contributions to meteorological education in recent years. R. DEC. W.

Étude sur la Situation de l'État indépendant du Congo. Félicien Cattier. Seconde Edition. Bruxelles et Paris. 1906. (3.50 fr.)

This mainly controversial and polemic book bears to a certain extent on geographic topics, through the statistics it presents of some branches of the production and income yielded by the Congo Free State. But its main object is political, in that it takes part in the Congo controversy begun by England in 1893 and carried on

since with considerable bitterness on both sides. With that controversy we have nothing to do; it is a political matter. and we confess ourselves unable to formulate an opinion on the merits of the case. Since where there is smoke there must be fire, it seems likely that at least some of the attacks on the Belgian Government, perhaps personally on the Sovereign himself, are justified, but we have not been able to understand by what right England and the English can claim interference in the affairs of another nation. It is and has been, however, English policy or English tactics, since the sixteenth century, to divert the attention of other nations from the failings and crimes of England by raising a hue-and-cry concerning abuses committed elsewhere, and in these tactics the establishment of the truth has been subordinate to the creation of a certain effect. The world, at last, has caught a glimpse of these methods; they have grown stale and transparent, and the inventive genius of the English might well produce new ones to cover up their sins or to initiate plans of expansion at the expense of others. These slight objections to the opening of the anti-Belgian campaign with regard to the Congo having already been raised during its progress, we merely allude to them without discussing their merits.

Professor Cattier makes two declarations which place him on firm ground. He says:

> I believe that, under the actual political conditions of Europe, a monarchical form of government is the one that serves best the interests of the country.

And again:

> I harbor the firm conviction that the Congo is not only useful and necessary to Belgium, but that, besides, Belgium could not give it up without incurring a grave moral forfeit.

While a strict partisan of the charges made against the present administration of the Congo, the author declares that, in his eyes, the radical remedy for the situation is annexation of the Congo to the Belgian kingdom, thus putting an end to a situation which is dubious aud ill-defined. That remedy is certainly patriotic from his standpoint, and it may yet prove to be the only practical one.

Professor Cattier reviews the wrongs which the natives are said to suffer in considerable detail. His aim is to refute the report of the Investigation Committee on the affairs of the Congo, and to expose defects in the workings of that commission. In the course of his scathing and merciless review, great abuses are brought to light, although the administration of colonial domains by England, for instance, has had phases which throw the alleged Belgian misdeeds considerably in the shade. The present work does not by any means close the dispute; and while giving every credit to Mr. Cattier for sincerity of purpose and honesty, we must wait for the other side to reply. They are certainly entitled to a hearing. A. F. B.

Die Vulkanberge von Colombia. Alfons Stübel. (Edited by Th. Wolf.) Dresden, W. Baensch. 4to. 1906.

This posthumous work of the distinguished geologist and explorer is a complement to the one published during his lifetime—"Die Vulkanberge von Ecuador." The latter appeared in 1897, seven years previous to the death of its lamented author. The editor (himself an authority on the geology and vulcanology of Ecuador) has made but very few changes in the original text, and has always carefully noted when such was the case. In regard to the last section of the book: "A Glance at the Workshop of Volcanic Forces," Mr. Wolf declines any participation or responsibility. He has given the words of the author without commenting upon them. It is the third part, and exclusively theoretical. Aside from voluminous tables of geographical positions, distances, and meteorological observations, the bulk

of the text is devoted to explanations of the numerous and very valuable views of the volcanoes of Colombia. These views, mostly copies of drawings made by Dr. Stübel on the spot, are executed with the utmost care and the greatest attention to characteristic detail. To these handsome plates are added a map of the volcanic region of Colombia based upon the one by Codazzi, one of the volcano of Tolima, and a sketch map of the group of Cumbal and Chiles, all by the hand of Stübel. Whoever has lived in the higher mountain regions of South America cannot fail to bear testimony to the truthfulness with which the solemn, grand, but bleak and forbidding landscape is rendered by Stübel's skilful pencil.

In treating of the volcanic mountains of Colombia, Stübel very naturally does not include the Isthmus of Panama:

> It forms, with its trachytes and basalts, something like an ancient volcanic bridge between the new volcanic regions of South and Central America.

The volcanoes of Colombia cluster in three groups. The most northern and the most southern are the best-known; the former including the Tolima, the truncated cone of which is quite characteristic. The southern group is that about the volcano of Pasto, of the pre-Columbian eruptions of which traditions are preserved from the time of the Conquest. The highest of all is the Huila (18,860 feet), nearly equidistant between the two. Stübel enumerates seventeen cones, few of which are now active. He merely alludes to the volcanic chain of "La Fragua," for the very good reason that it has never been explored or even visited by scientific explorers, although its appearance, from a distance, would lead to the inference that it is volcanic. With the exception of that mountain or range, the central Cordillera of Colombia alone has volcanoes, both the eastern and western branches being free from eruptive centres.

To follow the author through his elaborate descriptions of every one of the volcanoes illustrated in the volume is out of the question. We can only mention them in acknowledgment of his thoroughness. They are interspersed with some ethnological notes, for instance, on the Sebondoi Indians near the Putumayo. More attention is attracted by the theoretical part of the book (III), the one in which Stübel's theory on vulcanicity is expounded. It is not new. He had treated the subject already in connection with the volcanoes of Ecuador only; in this last discussion he draws most of his material from phenomena presented by volcanoes of the Mediterranean, beginning, of course, with Vesuvius and the eruptions (submarine) near Santorin.

The history of these eruptive centres is the longest and best-known, hence far better studied than those of any other part of the globe. Still, it may be regretted that Stübel did not extend his discussion of volcanic action to other regions with which he was specially familiar. He assumes:

> The volcanic phenomena of the present—in so far as the sum of observed facts allows an opinion—have their origin in localized, that is, circumscribed, and hence exhaustible, centres, and not in a common central focus, placed at incalculable depths and common to all volcanic phenomena of the earth's surface.

Still, he regards the existence of a great central hearth as not improbable, although its reactions towards the earth's crust no longer reach the surface. Every volcano is, therefore, in dimension and form, a picture of the peripheric hearth (so Stübel defines it) by which it has been created, and the violent manifestations of such a focus, called eruptions, tend to re-establish an equilibrium disturbed by excessive accumulations of incandescent matter or "magma," by ejecting that matter to the earth's surface. These restorative crises have produced themselves in many cases but once, in others twice and even more often, and what we call a volcano in a permanent state of activity is in fact not the beginning but the *close* of the eruptive state, the final emptying

of the hearth and its return to complete rest. The duration of the crises and the length of intervals (affecting a certain periodicity) between them are, of course, indeterminable, since their causes lie hidden from direct observation; but each may last untold centuries.

The first eruption is the one that has given form and has outlined the bulk of the mountain. It has not always culminated in an ejection of incandescent matter; quite as often the formation of a huge swelling has been the only visible outcome. But from the phenomena presented by the volcanoes of Mediterranean Europe, or by the Azores, etc., upon which the author lays particular stress, that earliest protuberance was followed by the appearance of a second one (after an undetermined period) alongside of or superimposed on the first upheaval. Eruptions subsequent to the latter initiate the dying out of the "peripheric" focus, its final emptying, and this stage Dr. Stübel characterizes as what is generally called "permanent activity."

As closing scene of the whole, he suggests that a remnant of the liquid eruptive mass, unable, from its reduced quantity or from lack of lifting power, to reach the rim of the opening, sinks back into the depths out of which it has risen. The consequence would be a crumbling of the walls of the pit, followed by a collapse and filling up by débris from the upper sections. In this manner the conic or dome-shaped form would result, proceeding, not as hitherto admitted, from successive heaping up of erupted material, but from a process of interior crumbling. It would not be a phenomenon of accumulation but one of reduction, accompanied by a closing of the original channels.

Dr. Stübel inclines to the belief that the most colossal volcanic mountains are the result of the earliest "reactions of the earth's interior against its shell," as we might say, paraphrasing the well-known expression of Humboldt, from a time when that shell began to solidify. The continuance of that reaction in its present form he also considers as probably due to further retraction, forming focuses made incandescent through pressure, "peripheric hearths," at a much lesser depth than the hypothetic fiery nucleus, the actions of which are no longer perceptible on the earth's surface.

These are, in the main, the distinguished scientist's theoretical views on terrestrial vulcanicity. It behooves us not to discuss them. The ultimate form of a volcano regarded as extinct, whether a closed cone or dome, or a mountain having in its summit a cauldron-like depression indicative of an extinct crater, is attributed in the main, by Stübel, to a collapse of the conduits through which the eruptive material was wont to emerge. There are instances, however, when the summit seems to have been shattered as if by a tremendous explosion. The craters of the long-extinct volcanoes of Quimsa-pata near Siuani in southern Peru, and the history of the formidable eruption of Omate (also in southern Peru) in 1600, might lead to the surmise that a part of the top was actually removed or blown off by the eruption and its mass reduced to ashes and lapilli (chiefly the former), scattered over an enormous area. While it may not have been the principal agent in shaping the mountain as it is now, the suddenness of the outbreaks (in the case of Omate and Mont Pelé), their coming on without premonitory symptoms and with a violence hardly equalled again during the continuance of the cataclysm, the enormous amount of finely-pulverized matter scattered broadcast over thousands of square miles, seem to favour the conception of an explosion to which, at least, the beginnings of the shape of the mountain as it is now may be due. A retreat of the remaining incandescent mass towards the earth's interior has certainly contributed to modify the form thus first produced, by enlarging cavities and widening its rim through cavings and slides, but the initiatory explosion can, it seems, hardly be overlooked as a factor. Besides the examples

quoted from South America and the Antilles, the catastrophe of Tamboro on the Island of Sumbava (1815), of Coseguina in Central America, of Krakatau near Java, recall similar causes. It is perhaps a question whether the, not very rare, cases when eruptions of appalling violence came without premonitory symptoms should not be attributed to explosion from within, and the removal of their summits to that force rather than to a retreat towards the interior. A. F. B.

Cities and Sights of Spain. A Handbook for Tourists. By Mrs. Aubrey Le Blond (Mrs. Main). xv and 214 pp., many illustrations from photographs by the author, index, and map. George Bell & Sons, London, 1904.

In three visits to Spain the author travelled about 6,000 miles. Her book is meant to supplement the guide-books, and especially to make it easier for tourists, while in Spain, to get along without most of the books that are still thought to be essential to travelling in that country with most enjoyment and profit. She thinks that no other part of Europe "offers so varied and attractive a field to nearly every type of traveller." The Spanish Government and people are now exerting themselves in many ways to make travel pleasurable, and to turn a larger part of the tide of tourists in their direction, with the result that the number of travellers is increasing every year. This is a thoroughly helpful and an interesting little book. A black-and-white map gives the plan of a tour that includes practically all the points of interest in the country. Travelling in Spain seems to be cheaper than in most other European countries. The author found on her second tour that for five weeks and three days in Spain the cost was $150, including first-class fare on the railroads and the best hotels.

The Masai, their Language, and Folklore. By A. C. Hollis. With Introduction by Sir Charles Eliot. xxviii and 356 pp., 27 Plates of Illustrations, Index, and Map. Clarendon Press, Oxford, 1905. (Price, 14s.)

Mr. Hollis is Chief Secretary to the Administrator of the British East African Protectorate, and is well known for earlier contributions to African anthropology. For ten years he had large opportunity to study the Masai, and his linguistic talent and anthropological training have enabled him to get at the heart of their mental and physical life. The result is a work of great thoroughness and excellence. He has produced the best book in English on this important African family.

The Masai live in the inland districts of British and German East Africa, between the Equator and 6° S. Lat. Most of them have been pastoral nomads, but there is also a small agricultural element. Until about twenty-five years ago they were the most formidable tribe in East Africa. They kept the Arab slave traders at bay, levied heavy tribute upon all who passed through their country, delayed for years the exploration of tropical East Africa, and treated all other races with the greatest arrogance. But the past quarter of the century has been disastrous for the race. Most of their cattle were swept away by rinderpest, great numbers of the tribe fell victims to smallpox, neighbouring tribes rose against them in their weakness, and their numbers were further reduced by famine. It is believed that only 12,000 to 15,000 are now living. To save them from extinction Mr. Hollis says that :

> Every support should be given to the Church Missionary Society and to the other missions, for it is only by the gradual and peaceful civilization of the tribe that they can be saved from extinction.

What Mr. Hollis has done in this book is to place within reach of all a knowledge of the language and customs of the Masai. Comparatively little has been known of this language, and Hollis's exposition of it will be of interest to philologists and

of practical importance to the whites, who, in increasing numbers, are coming into contact with the natives. As Sir Charles Eliot says, if one wishes to be on friendly terms with other races, and to avoid misunderstandings, the first essential is to speak their language. The Masai are delighted to converse with Europeans, and if they had been capable of giving or receiving explanations when trouble was brewing much disastrous misunderstanding would have heen avoided.

Mr. Hollis gives 101 pp. to the grammar, including rules for pronunciation, and a large vocabulary. He has made the grammatical system of the Masai language coherent and clear. The language has many peculiarities. It shows a marked inclination for long formations, and until the articles, relatives, verbal prefixes, and affixes have been separated, it is impossible to discover roots, or even the simple forms of nouns and verbs. Much still remains to be done, but the general structure of the language appears at last to be established beyond doubt.

Nouns in Masai are not susceptible of any inflections to mark the cases; but the article has special forms to denote the nominative, vocative, and genitive. Many substantives are derived from verbal roots. Perhaps the most complicated part of the language is the formation of the plural of nouns; and Mr. Hollis gives 17 pp. to the discussion of this topic. There are no degrees of comparison in the forms of adjectives, and the author shows the various ways in which the comparative and superlative are expressed. Forty-nine pp. are given to the verb. There are few conjunctions, no real prepositions, but a large number of interjections.

Two-thirds of the book are devoted to the stories, proverbs, riddles, and songs, and to an account of the customs and beliefs of this interesting people. A delightful peculiarity of this long narration is that the whole is given in the words of the Masai themselves, which were put on paper in their language as the author received his information. The English translation is printed, line by line, under the Masai words, or the two are presented in parallel columns.

The stories, songs, and proverbs show considerable imagination, and naturally bring into clear light the ideas and motives at the basis of the native character and life. Their proverbs often give the essence of our own. "Do not jump about, for there is no use in it," is another way of saying "The more haste, the less speed." "We begin by being foolish, and we become wise by experience" is, of course, only another form of "Experience is the best teacher." The Masai say "Flies have ears," and we say the same thing of "Little pitchers." "Mountains do not meet" is often said when persons part company, and is equivalent to the Turkish proverb, "Mountain does not meet mountain, but man meets man."

The long section on Masai customs covers many phases of their migrations, work, attire, ceremonials, weapons, military code, social ideas and habits, religious beliefs—which are vague and unformulated—crimes, etc. Here is a simple account of Masai fire-making:

> When the Masai move and go far, the men take with them, or cut on the spot where they intend to stay, a hard pointed stick and a flat piece of wood. They then search for some donkey's dung or dry grass, and produce fire in the centre of the new kraal by drilling the stick into a hole in the wood. When the fire has reached the grass they set light to some leaves of *Cordia ovalis* and throw wood on to the fire. The women obtain their fire from the one which the men have made. When the journey is a short one the women carry fire with them.

Sir Charles Eliot, formerly Administrator of the British East Africa Protectorate, supplies an introduction in which he discusses the still vexed question of the origin of the Masai and compares them, as to their language and customs, with other East African and Nilotic tribes. The book is one of the most striking of recent illustrations of the great progress we are making in knowledge of Africa and of its peoples.

The Geology of the Hokitika Sheet, North Westland Quadrangle, with which has been included a small portion of the upper Wilberforce valley, in the Waimakariri Quadrangle. **By James Mackintosh Bell, assisted by Colin Fraser.** Bulletin No. 1 (New Series) New Zealand Geological Survey, Department of Mines, Wellington, New Zealand, 1906. xi and 101 pp., 32 plates, 9 maps, 4 geological sections and 11 micro-photographs.

Every new country must apparently be explored at least twice before it can be said to be fairly well known—once by the explorer, who, in a rapid reconnaissance, discovers the existence and location of its mountains, plains, streams, peoples, etc., and again by the trained geographer or geologist, who, by later detailed examination, checks the earlier determinations, discovers or works out the genesis and relations of structure, topography, and drainage, and describes these in systematic terms, thus making the region intelligible to those to whom all lofty snowclad mountains or low coastal plains are not alike.

New Zealand will certainly become well known in the latter way, if succeeding bulletins of its recently-reorganized Geological Survey live up to the promise of this the first number in the new series, by Dr. James Mackintosh Bell, the Director.

The volume is of special interest to the geographer by reason of the two important chapters, "General Culture" and "The Physical Geography of Westland," in which are described the towns and settlements, means of communication, inhabitants, flora, fauna, soil, and climate of the area referred to in the title. A considerable part of this section is also devoted to a well-phrased description of the most important topographic features.

Westland has long stretches of harbourless coast; and even where harbours occur they are frequently shallow and difficult of entry—a fact which greatly retards the development of the district. Overland communication with the eastern and better-favoured parts of the island is by means of a few roads and more frequent bridle-paths and trails. The last named were used for generations by the Maoris, who migrated to the west coast, and in calm weather searched the shores in canoes for the much-coveted greenstone.

The chief physiographic provinces of Westland, named in order from the hinterland to the shores of the Tasman Sea, are an alpine chain, with many splendid and lofty snow-covered peaks; an elevated and now well-dissected peneplain 4,000 to 5,000 feet above the sea, surmounted by an occasional rounded residual mountain; and a young coastal plain with outliers of the peneplain on its inner margin.

The general direction of the alpine chain is northeast. The structure is synclinal in the main, and the highest peaks consist of grauwacke or sandstone, and stand at elevations varying between 6,000 and slightly over 7,000 feet. Avalanches of snow are of common occurrence at the heads of the higher valleys. These are sometimes of huge proportions, and bring down as low as 3,000 feet quantities of snow so large that they are frequently not melted by the heat of the ensuing summer. Almost every alpine valley has such masses of hardened snow at its head. The glaciers themselves are not large, but are the shrunken remnants of once extensive ice fields and glaciers. An interesting circumstance is the absence, with one exception, of rock-flows in the streams draining the glaciers, due, no doubt, to the inefficiency of the present weak glaciers in eroding the beds of hard rock scoured clean by the former powerful ice-sheet. The common phenomena of glaciation are noted at low as well as at high elevations, and Bell's work on the glacial and fluvio-glacial deposits of this district constitutes, with the work of Agassiz, Gregory, Andrews, Thatcher, and many others, convincing proof of former more extensive glaciation in the

southern as well as the northern hemisphere. *Roches moutonnées*, glacial striæ, and glaciated boulders are common, and can certainly not be questioned in view of the author's extended experience in the glaciated regions of Canada. The V-shaped valleys, represented in the plates and described in the text, are indicative of strong ice erosion, as are also the abruptly truncated spurs of the pre-glacial valleys and the frequent cirques, rapids, falls, and hanging valleys.

The uplifted peneplain (Wainihinihi) has been very deeply dissected, and near the major streams is distinctly mountainous, so that the principal elevations here receive distinctive names—a feature similar to that noted in the Acadian peneplain by Daly. Alpine or subalpine vegetation is found all over the surface of the peneplain, the ranges being quite free from snow at the close of summer. The sides of the valleys carved below the level of the uplifted plain have been smoothed and steepened by ice-action in a significant manner.

The coastal plain, fronting the Tasman Sea on the coast of Westland, is a very complex physical feature. Three distinct cycles of development are noted : an early cycle, in which beds of gravel and clay were raised above the sea and dissected ; a second cycle, in which this dissected plain was submerged, partly buried under new sediments and elevated with remnants of the older plain, standing in relief above the modern feature ; and the present third cycle of development, in which the valleys have become extensively terraced. The present cycle has been complicated by glaciation—a fact accounting for the tremendous amount of irregularly-deposited glacial débris forming much of the surface of the modern coastal plain. The greatest width of the plain is fifteen miles, and the maximum elevation of its inner margin about 600 feet.

Special attention is directed to the maps and excellent photographs accompanying this report, which depict the topographic features, the drainage, the glaciers, etc., of a district practically unknown to American geographers, although earlier papers dealing with other sections of New Zealand had portrayed more or less similar features elsewhere.

It is hoped that future publications in this series will extend the geographic as well as the geologic work begun in the first *Bulletin*, that by this means we shall soon be enabled so have a thoroughgoing and complete regional geography of this interesting island group. I. B.

Uganda to Khartoum: Life and Adventure on the Upper Nile. By Albert B. Lloyd. xii and 312 pp., 80 Illustrations, and map. E. P. Dutton & Co., New York, 1906. (Price, $3.)

This is a record of travel, adventure, and work among the natives of the northern provinces of the Uganda Protectorate, a part of Central Africa very little known to the public. The author is a missionary who has lived ten years in Uganda. His latest book depicts his experiences during a five-years' residence in the northern provinces and describes his journey down the Nile on a vacation trip to Europe.

Mr. Lloyd is one of the comparatively few men who have special capabilities for such pioneering service as he has rendered in Africa. His book is interesting and instructive. It is not a missionary work, and it deals briefly with missionary effort; but it presents Africa as a land of darkness, of fascinating adventure, and of immense possibilities, in whose future the author has unbounded confidence.

The numerous half-tone illustrations give glimpses of many phases of life in Central Africa that could scarcely be imparted so vividly by any written description. Many of them give entirely new aspects. One, for example, shows some half-clad

natives in the foreground, while behind them, on the well-built highway, is a black man, naked to the waist, leaning on his bicycle. We are introduced to the new industries which the whites have taught to the people, such as lumber and brick manufacture. Another plate shows the interior of the Cathedral of St. Paul at Mengo, which holds 3,000 persons, and in whose construction 750,000 brick were used. Times are changing in Africa, and no book illustrates the fact better than this volume.

Mr. Lloyd founded the mission in the province of Bunyoro, which, not many years ago, was the scene of the inhuman practices of King Kabarega and the bands of robbers that he turned loose to prey upon his own people. Bunyoro's misery is now in the past, and the country is holding up its head again; for it has a Christian king, a son of Kabarega, who takes genuine delight in the most energetic efforts to uplift and help his countrymen. Medical missions and the civilizing influences of industrial education are accomplishing great things in Bunyoro.

The geographical interest of the book is chiefly centred in the description of the remote Acholi country, a little-known region north of the westerly bend of the Nile. After his mission in Bunyoro was well on its feet, Mr. Lloyd went among the Gang, as the people of Acholi call themselves, to begin his civilizing work in that virgin field. He impresses us with the fact that many of these barbarous tribes are learning of the helpfulness which the whites have brought to other African peoples and are eager to enjoy the same advantages. This was the case among the Gang, who were reputed to be dangerous and inhospitable; but they have opened wide their doors to the white teacher, and his work now flourishes among them.

Their country is a region of fine, open plains, above which rises, here and there, a majestic mountain. Tropical forests are scattered over the plains; and though the heat is intense in the lowlands bordering the Nile, the climate of the eastern uplands is healthful to Europeans. In Mr. Lloyd's account of these formerly mistrusted barbarians, he emphasizes the high average morality among them.

His description of the journey down the Nile is the first detailed account we have seen of the conditions of travel there, now that steamers make regular trips between Khartum and Gondokoro. The book is one of the best works on the regions of which it treats, and it completely illumines the present conditions there.

Highways and Byways of the Mississippi Valley. By Clifton Johnson. xiii and 287 pp. and 63 illustrations. The Macmillan Company, New York, 1906. (Price, $2.)

Mr. Johnson followed the river from New Orleans to near its source, and, in his desire to avoid aspects with which all are familiar, he chiefly haunted the byways, travelling on the country roads, living among the people, and studying their lives and toil. His literary material deals with the unhackneyed and unconventional. He has garnered the quaint, the characteristic, and the little known, and tells much of his story in the monologue and the dialect of his informants. As his narrative abounds with anecdote, and his descriptions are clean-cut and photographic, his work is both entertaining and edifying. He is a keen observer, and has an eye even for the little things that reveal character and conditions.

Mr. Johnson is certainly one of the first authors to give a vivid description of the swamp region of the lower Mississippi, where he made the acquaintance of moss-pickers, and was rewarded for his hardships with much novel material for his book. The reader is certain to become interested in Jake, an alligator hunter whose energies are given to catching little alligators to be shipped to menageries, or to any one who

delights in that kind of a pet. Jake is photographed in the act of pulling a young alligator out of his hole by the snout. The photographs are unusually good, and most of them illustrate phases of life among the lowly. Mr. Johnson has written a considerable number of books, but none of them contains more new information of interest to readers than this volume.

Algiers. By M. Elizabeth Crouse. Illustrated by Adelaide B. Hyde. xii and 244 pp., 24 illustrations, and Index. James Pott & Company, New York, 1906. (Price, $2.)

The author lived five months in Algiers taking notes for this volume. She has also been in Tunis, has spent a winter in Egypt, and it seems to her that in neither of these countries "does the Oriental life compare with that in Algeria, both for grace and beauty." Her book is filled with vivid pen-pictures of the monuments the Deys left behind them, and of the lives of the people among whom Western civilization has been introduced by the French. She sees the spirit of the East still alive and poetic beauty and charm still pervading the old Moorish villas, gardens, and mosques; and with sympathy and enthusiasm she tells the story of this city where the East and the West have met, threads the narrow passages of the old town to study the monuments of what has been, and mingles the history and the romance of the old palaces in giving her impressions of them.

We usually hear more of Algiers than of Tunis, and many persons imagine that the former city is materially more important. The fact is that Tunis is nearly three times as populous as Algiers, and the author makes some interesting comparisons between them:

> Tunis is not nearly so beautiful as Algiers, for it is flat upon the sand and lacks the stately arches of the arcades and of the ramparts which conceal the steep cliffs at the foot of the latter city. . . . The whole difference between Tunis and Algiers might be summed up as follows: In Algiers the Arab life is buried, the city belongs to the French, and the French are destroying the Oriental to build a modern Western town. In Tunis the Arab life goes on in all its vigour, protected, not suppressed by the French, who may not destroy anything. Neither are there the oppressive taxes and heavy duties of Algiers. It is therefore much more prosperous and appears so even in the French settlement. And yet the Algerian Moorish life in passing seems to be most beautiful.
>
> Ruin has well been called "the charm beyond perfection." It is the freeing of the spirit. And that moment while the spirit lingers is most exquisite of all. It is that period in Algeria now. The French conquest, while destroying and covering much, has caused the Oriental life to reveal its most spiritual loveliness.

The book is permeated with sympathetic interest and imagination. It was well worth writing. Some of its half-tone illustrations are especially charming and characteristic.

Handbook of Polar Discoveries. By A. W. Greely, Major-General U. S. Army. (Third Edition, Revised and Enlarged.) iv and and 325 pp., Portrait, 12 Maps, and Index. Little, Brown & Co., Boston, 1906. (Price, $1.50.)

General Greely's handbook has grown from 257 pp. in the first edition, ten years ago, to 325 pp. It is now a polar instead of merely an Arctic manual, for it summarizes Antarctic discovery from the earliest days to Charcot's expedition of 1903. The important work of the past decade in the Arctic domain has also added a considerable number of pages. No handbooks on exploration are likely to be so useful in the coming years as those relating to the polar regions, for these zones now offer the largest opportunities for pioneer research; and this manual, covering the whole field of polar work, and written with authority, is very conveniently arranged for reference. It gives the larger facts relating to the whole field of polar endeavour, and the copious

bibliographies closing the chapters and at the end of the book refer the student desiring more details to a large number of literary authorities. The book compresses the vital features of 7,000 pages of original narrative; and though it is very condensed, it gives a good and clear idea of what has been accomplished in this department of geographical discovery.

Statistique Annuelle de Géographie Comparée, 1906. By Jean Ribot. 30 pp. Hachette & Co., Paris, 1906.

This is a very compact and well-arranged collection of the latest statistics relating (1) to the population of countries and cities, with figures of their growth, emigration, etc.; (2) food stuffs showing their production, consumption, exportation, and importation in each country; (3) production of textiles, in each country, with their value, exportation, importation, and manufactures; (4) similar information for coal, lignite, iron, copper, and other metals. These statistics are arranged in tables covering the world, and followed by more detailed tables relating to France. The remainder of the pamphlet gives maritime statistics of all the leading ports; figures relating to interior navigation, railroads, the commercial movement by countries, and values of the commodities in trade; and the pamphlet concludes with tables showing the military and naval strength and financial condition of all the leading countries. Few compilations of this sort are planned in a way to give so much information in little space as this small book.

OBITUARY.

S. NICHOLSON KANE.

Mr. Kane had been failing in health for more than a year when the end came on the 15th of November, 1906. The Council of the Society, at a meeting held on the 20th of December, adopted the following Memorial Resolutions:

Resolved, That by the death of Mr. S. Nicholson Kane the American Geographical Society has lost a loyal friend and a valued Councillor.

He became a Fellow of the Society in 1879 and a member of the Council in 1896.

He took an intelligent interest in the affairs of the Society, and always performed with alacrity, zeal, and scrupulous care all duties which were confided to him. By his cheerfulness and unfailing courtesy he endeared himself to all with whom he came in contact.

Resolved, That a copy of the above resolution be transmitted to the family of Mr. Kane, with assurance of the sympathy of the Council.

INDEX TO VOL. XXXVIII.

MAPS AND ILLUSTRATIONS.

MAPS.

ILLUSTRATIONS.